EXHIBIT 25

CONFIDENTIAL

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF PUERTO RICO

In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of THE COMMONWEALTH OF PUERTO RICO, et al. Debtors.	PROMESA TITLE III Case No. 17-BK-3283-LTS (Jointly Administered)
In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of THE PUERTO RICO ELECTRIC POWER AUTHORITY, Debtor.	Case No. 17-BK-4780-LTS **This Court Filing Relates Only to PREPA and Shall be Filed Only in Case No. 17-BK-4780-LTS and Main Docket 17-BK-3283-LTS**

EXPERT REPORT OF SUSAN TIERNEY, PHD
APRIL 28, 2023

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I. QUALIFICATIONS

1. I am Susan Tierney. I am a Senior Advisor at Analysis Group, Inc., an economics consulting firm headquartered in Boston, Massachusetts.

2. I spent much of my career working in Massachusetts state government on matters related to the electric industry—first as the electric-industry economist for the state's energy office; then as an analyst and ultimately the Executive Director of the state's Energy Facilities Siting Council (the agency that reviews electric utilities' long-term demand forecasts, supply plans, and facility proposals); then as Commissioner of the Department of Public Utilities (the regulatory agency with ratemaking oversight and approval for utilities in the state); and then as Secretary of Environmental Affairs (the cabinet officer for environmental regulation and programs). At the U.S. Department of Energy, I served as Assistant Secretary of Policy with responsibility for a range of matters related to the nation's electric, gas, oil, coal, and other industries.

3. For more than two decades, I have consulted to companies, government entities, grid operators, non-profit organizations, large electricity consumers, and others, on energy and environmental economics, policy, ratemaking, and regulation, and served as an expert witness in litigation on the same topics. Throughout my consulting practice, as in my government service, I have had experience with electric utility ratemaking, demand forecasting, and supply planning. Among the many pro bono activities I have undertaken since leaving government are the following: chairing the Department of Energy's Electricity Advisory Committee; chairing the External Advisory Board of the National Renewable Energy Laboratory ("NREL"); and serving as a member of several committees of the National Academies of Sciences, Engineering and

Medicine (including the committees on the Future of Electric Power in the U.S., the Role of Net Metering in the United States, Enhancing the Resilience of the Nation's Electric System, and Decarbonizing the U.S. Energy System).

4. I have a Ph.D. and Master's degree in regional planning from Cornell University. A copy of my curriculum vitae is attached to this report as **Appendix A.**

5. Analysis Group is being compensated for my time in this matter at a rate of $920 per hour. In carrying out my assignment, I have directed and supervised employees of Analysis Group, though the views and conclusions in this report are mine. My compensation is not contingent on the content of my opinions or on the outcome of this matter.

6. In preparing this expert report, I, along with Analysis Group staff working under my direction, have reviewed various documents and data sources. I attach a list of documents and sources which I have considered as **Appendix B** to this Report.

II. ASSIGNMENT

7. I have prepared and submit this Report pursuant to Analysis Group's retention by the Ad Hoc Group of PREPA Bondholders,[1] Syncora Guarantee, Inc., Assured Guaranty Corp., and Assured Guaranty Municipal Corp. (collectively, "Bondholders"), in connection with their objections to confirmation of a plan of adjustment (the "Plan of Adjustment" or "Plan") filed by

[1] The Ad Hoc Group of PREPA Bondholders includes BlackRock Financial Management, Inc., Franklin Advisers, Inc., GoldenTree Asset Management LP, Invesco Advisers, Inc., Nuveen Asset Management, LLC, Taconic Capital Advisors L.P., and Whitebox Advisors LLC.

representatives of the Financial Oversight and Management Board ("FOMB" or "Oversight Board") on behalf of the Puerto Rico Electric Power Authority ("PREPA").[2]

8. I have been asked to:

- Assess the reasonableness of key elements of PREPA's projection of its customers' future demand for electricity—its "load forecast"—which is a significant input into the model by which the FOMB derives its proposed Legacy Charge. I also analyzed how PREPA's existing projection of future gross load would change by adopting Dr. Sebastian Edwards's macroeconomic projections.[3] I also analyzed the predictions and assumptions—about the adoption of energy efficiency, distributed generation (including rooftop solar panels), and electric vehicles—by which PREPA modifies its gross load forecast to arrive at the net load forecast the FOMB used for its Legacy Charge model.

- Assess the FOMB's assertions related to the future price elasticity of electricity demand.

- Assess the FOMB's projection of PREPA's future capital costs, including costs assumed by the FOMB's Legacy Charge model that are additional to the capital costs already included and approved in the 2022 PREPA Fiscal Plan.[4]

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[2] Disclosure Statement for Modified Second Amended Title III Plan of Adjustment of the Puerto Rico Electric Power Authority, *In re: The Financial Oversight and Management Board for Puerto Rico, as representative of the Commonwealth of Puerto Rico, et al., Debtors*, PROMESA Title III No. 17-BK-3283-LTS, and *In re: The Financial Oversight and Management Board for Puerto Rico, as representative of Puerto Rico Electric Power Authority, Debtor*, PROMESA Title III No. 17-BK-4780-LTS (Jointly Administered), United States District Court for the District of Puerto Rico, San Juan, Puerto Rico, dated March 1, 2023 (hereafter "Disclosure Statement"). Disclosure Statement Exhibit A: Modified Second Amended Title III Plan of Adjustment of the Puerto Rico Electric Power Authority (hereafter "Plan of Adjustment").

[3] Expert Report of Sebastian Edwards, April 28, 2023 (hereafter "Edwards Report").

[4] PREPA, "2022 Certified Fiscal Plan for the Puerto Rico Electric Power Authority," FOMB_PREPA 00000699 - FOMB_PREPA 00000882 (hereafter "2022 PREPA Fiscal Plan").

• Assess the type and extent of unpaid historical bills and of Contributions in Lieu of Taxes ("CILT") from PREPA to governmental and municipal entities that are paid for by other PREPA customers.

III. SUMMARY OF FINDINGS AND CONCLUSIONS

9. It is my opinion that the "Base Case" net load forecast of PREPA's future electricity demand—as reported in the 2022 PREPA Fiscal Plan and that the FOMB uses to calculate its proposed Legacy Charge—greatly underestimates PREPA's future sales of electricity. It predicts that PREPA's electricity sales will decline by more than half over the next decade. The FOMB reaches this conclusion as the result of several unfounded and unreasonable assumptions, which render that forecast unreliable.

10. The FOMB's net load forecast begins with a gross load forecast that is also taken from PREPA's 2022 Fiscal Plan. I note that Dr. Edwards concludes that the gross national product (GNP) and population projections taken from the Commonwealth's 2022 Fiscal Plan (which are used by PREPA to arrive at their gross load forecast) are understated. As a result, PREPA and the FOMB substantially understate the likely gross load over the coming decades. That distorts the starting point for the net load modifiers that I assess.

11. Those load modifiers are derived from a Base Case net load forecast that reflects a series of adjustments made to the gross load forecast. The 2022 PREPA Fiscal Plan also presents an "Alternative Forecast" of gross and net load that is substantially more realistic than the Base Case—but which is ignored in FOMB's Legacy Charge analysis. Unlike the Base Case, the Alternative Forecast is based on actual experience and constraints in achieving certain energy policy goals. While PREPA's Alternative Forecast is flawed as well, it nevertheless provides a

more defensible and appropriate starting point for projecting load for purposes of deriving a reasonable Legacy Charge.

12. In its Base Case, the FOMB makes a series of adjustments to its gross load forecast, to reach its Base Case net load forecast, which I understand is used to calculate the Legacy Charge. *First*, and most important, the FOMB assumes that Puerto Rico will achieve a 30% reduction in demand for electricity by 2037 relative to 2019, based upon the rapid and widespread adoption of energy efficiency measures. The sole basis for this assumption is a 2019 legislative enactment which stated that 30% figure as a target. But all available evidence demonstrates that target is unattainable. The proposition that Puerto Rico can achieve this goal of energy efficiency is inconsistent with (i) a competing and much lower forecast by LUMA of the potential adoption of energy-efficiency measures in Puerto Rico; (ii) Puerto Rico's low ranking compared to other U.S. jurisdictions for government-backed energy efficiency policies, programs and initiatives; and (iii) the FOMB's own Alternative Forecast, which is based upon actual data and undermines its aggressive Base Case assumption.

13. Second, FOMB further adjusts its gross electricity demand forecast downward on the assumption that Puerto Rico residents will rapidly adopt "distributed generation" technologies—principally rooftop solar panels—which will reduce demand on and purchases from the grid. Yet, the FOMB's base-case projection lacks supporting evidence. In fact, that projection fails to take account of the up-front cost of adopting solar energy (which is prohibitive to many residents on the island), as well as operational barriers, and a lack of adequate infrastructure to accommodate such a rapid adoption of solar power. And again, the FOMB's projection ignores its *own* bottom-up Alternative Forecast analysis, as well as the predicted

adoption rates of other states that are better positioned for the rapid adoption of solar energy systems.

14. Third, the adoption of electric-powered vehicles will increase demand for electricity, and therefore requires an upward adjustment to the gross load forecast. But the FOMB assumes that the growth in load due to electric vehicles in Puerto Rico will abruptly and completely halt in 15 years, with no further growth thereafter. The FOMB provides no basis for that assumption, which is contrary to the FOMB's own Alternative Forecast, industry and governmental forecasts, and common sense. In my opinion, each of these assumptions by which FOMB arrives at its net load forecast are unsupported, unreasonable and unreliable.

15. The FOMB's Legacy Charge Derivation[5] further modifies downward the already too-low Base Case net load forecast to account for an "elasticity effect," demand reductions that FOMB believes would result from any future rate increases not contemplated by the 2022 Fiscal Plan. This "elasticity effect" in the FOMB's Legacy Charge Derivation is significant—for example, the Oversight Board assumes a 1.7% drop in residential energy consumption for every 1% increase in price. According to the FOMB, that assumed reduction in demand "in turn will require increases to rates to ensure revenues are sufficient to pay all of PREPA's fixed costs."[6]

16. I find the FOMB's estimated long-term elasticity effect to be unsupported by the two academic papers on which it relies (one of which, notably, is a working paper). The FOMB's long-term elasticity estimates are also inconsistent with—and substantially higher than—the estimated elasticities reflected by an academic consensus demonstrated in surveys of hundreds of studies of the elasticity of electricity demand. The result is that the FOMB substantially

[5] Disclosure Statement Exhibit P: Legacy Charge Derivation (hereafter "Legacy Charge Derivation").

[6] Legacy Charge Derivation, p. 6.

overstates the extent to which increases in rates would suppress demand, which causes the FOMB to overstate the amount of potential new revenues that should be reserved to cover a supposed shortfall in funds to pay fixed costs instead of being available to fund creditor recoveries.

17. I also assess yet another adjustment made by the FOMB's Legacy Charge Derivation that has the effect of reducing the amount of potential new revenues the FOMB says are available to fund creditor recoveries—this time focused on estimated future capital expenditures. The FOMB proposes to reserve $2.425 billion in potential new revenues (and to not make those potential new revenues available for creditor recoveries), to provide for future capital expenditures *over and above* what is already projected and budgeted for in PREPA's 2022 Fiscal Plan. That is, whereas PREPA's 2022 Fiscal Plan forecasts annual capital expenditures based on projections and capital-expense planning, the Legacy Charge Derivation sets an unexplained higher target for such expenditures that is inconsistent with that Fiscal Plan, and then asserts that the difference must be taken out of any potential new revenues that otherwise would be available for creditor recoveries. This unexplained departure from PREPA's 2022 Fiscal Plan—which is already over-generous in terms of capital-expense forecasting—is inconsistent with standard utility planning and methodologically unsound.

18. Finally, I assess the FOMB's assumptions about the non-payment of balances owed to PREPA by governmental customers. In particular, I explain that sound utility planning and practice would require assuming that these governmental customers will pay their overdue balances. In fact, many of the entities in arrears are now under the FOMB's direct supervision. Payment of these unpaid governmental balances, as I explain, could make hundreds of millions of additional dollars available for creditor recoveries in the near term.

19. I understand that as part of her expert report, Dr. Maureen Chakraborty uses my findings on future electricity demand, price elasticity, and additional capital expense as inputs into her analysis of PREPA's ability to pay its creditors.[7]

IV. BACKGROUND

A. Load And Expense Forecasting By Electric Utilities

20. Public utilities, including PREPA, collect revenues from customers through sales of utility service at regulated prices ("rates") that may vary by customer type and usage patterns.[8] Rates are constructed to ensure "revenue sufficiency," which is achieved when the applicable rates multiplied by the volume of electrical demand (also known as the "load," which is in effect equivalent to the volume of sales) produces revenues sufficient to cover the utility's total costs.[9] In aiming for revenue sufficiency, therefore, utilities forecast both electrical demand and service costs.

21. Forecasting demand is necessary because electric utilities provide electricity service to customers "on demand," and thus need to anticipate the volume of electricity that customers will use in the future. A utility's forecast of its future electricity demand affects its

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[7] Expert Report of Maureen M. Chakraborty, PhD, April 28, 2023 (hereafter "Chakraborty Report").

[8] "Cost Allocation is the process by which a utility's costs are attributed to different customers. The fundamental objective is to ensure that the revenue burden is being equitably shared amongst each customer class." *See* National Association of Regulatory Utility Commissioners, "Primer on rate design for cost-reflective tariffs," January 2021, available at https://pubs.naruc.org/pub.cfm?id=7BFEF211-155D-0A36-31AA-F629ECB940DC.

[9] National Association of Regulatory Utility Commissioners, "Primer on rate design for cost-reflective tariffs," January 2021, pp. 8, 10, https://pubs.naruc.org/pub.cfm?id=7BFEF211-155D-0A36-31AA-F629ECB940DC.

short-term to long-term operational requirements, infrastructure planning, financial planning, ratemaking, and other core business functions.[10]

22. Given the lead times for many types of capital investments and other substantial financial commitments, it is normal practice for a utility to make long-term load forecasts. As a general matter, the further out into the future the forecast period goes, the more complex and uncertain the forecast will be. Over periods extending decades into the future, electricity demand will be affected by many things, including population shifts, the impacts of climate change, and a host of other technological, economic, behavioral, and physical factors.

23. Utilities also develop detailed capital-cost forecasts in the regular course of business. Electric systems are capital-intensive and making investments to maintain or replace system facilities and infrastructure is a normal part of the utility business. Capital costs (and the service of the debt that finances them) must also be recovered through electricity rates, making a utility's assumptions about its future capital needs a key input into its revenue-requirement and rate forecasts.

24. In my experience, it is critical that utilities engage in sound and unbiased demand-forecasting methods, using the best available data, and avoiding the adoption of aggressive and aspirational assumptions that do not comport with such information. Similarly, capital-cost forecasts must present realistic estimates of money needed for infrastructure maintenance, repair, and replacement, so that a utility collects enough to keep its system in good order while not overcharging customers.

[10] "Short-term" and "long-term" (and even "mid-range") time periods tend to have different meanings in different utility contexts. For the purposes of this discussion, I use "short-term" to describe a period of one year or less, "mid-range" to describe a period from over one year up to five years, and "long-term" to describe a period of over five years.

B. The FOMB's Legacy Charge Model Uses A Modified Version Of PREPA's Existing Base Case Load Forecast

25. It is my understanding that the FOMB's Plan of Adjustment for PREPA proposes a new Legacy Charge for PREPA customers to finance "New Bonds" that would be provided to PREPA's existing creditors as partial recovery of what PREPA owes them.[11] It is also my understanding that the amount of that Legacy Charge is derived from a model that is based on, among other things, PREPA's existing 2022 Fiscal Plan gross load forecast of the volume of electricity that PREPA would sell to customers from fiscal year 2023 through fiscal year 2051.[12] That gross load forecast is then adjusted by certain load modifiers to reflect customers' projected adoption of (i) energy efficiency measures and (ii) distributed generation technologies such as rooftop solar panels (both of which would result in a net *reduction* in load), and (iii) electric vehicles (which would result in a net *increase* in load) to create PREPA's Base Case net load forecast for that forecast period.[13]

26. I also understand that the FOMB's Legacy Charge Derivation (Plan Exhibit P) further modifies PREPA's Base Case net load forecast to account for an assumed future price elasticity of demand—that is, a reduction of future demand that would be caused by customers' responses to the price increase reflected in the Legacy Charge. **Figure 1** shows how the FOMB generated the modified net load forecast that it uses to derive its Legacy Charge proposal. Again,

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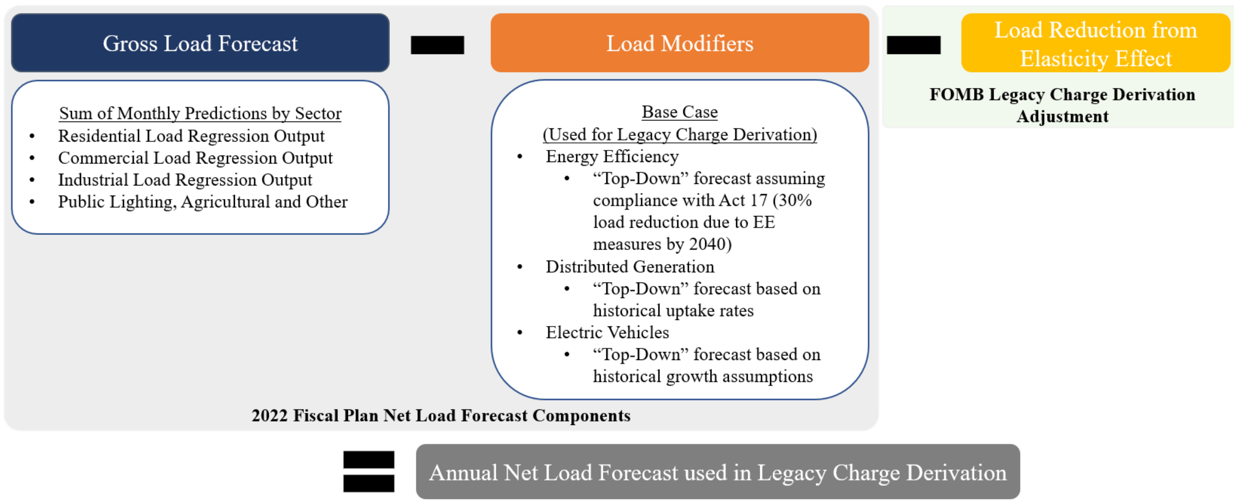
[11] Disclosure Statement, p. 5.

[12] PREPA's load forecasts are prepared for PREPA's fiscal years, which start on July 1 of the previous calendar year. For example, FY 2023 started on July 1, 2022 and will last until June 30, 2023.

[13] PREPA's "Base Case" is defined as "a load scenario that is based on assumptions for key gross load drivers (GNP and population projections consistent with Commonwealth Certified Fiscal Plan) and for key net load drivers related to energy efficiency (EE), distributed generation (DG) adoption and electric vehicle (EV) uptake. The net load driver assumptions in the Base Case are based on Act 17 compliance (EE achieving 30% target by FY 2040) and basic assumptions of future growth based on historical growth (DG and EV)." 2022 PREPA Fiscal Plan, p. 151; "PREPA 2022 Fiscal Plan Model.xlsx," FOMB_PREPA 00003018 (hereafter "2022 PREPA Fiscal Plan Model").

PREPA's Base Case net load forecast is based on adjustments made to PREPA's gross load forecast.

Figure 1: Components of PREPA's Net Load Forecast as Used in the Derivation of FOMB's Proposed Legacy Charge



Sources:
[1] Siemens, "Puerto Rico Integrated Resource Plan 2018-2019," June 19, 2019, Section 3-1, available at https://energia.pr.gov/wp-content/uploads/sites/7/2019/06/IRP2019-Main-Report-REV2-06182019-wERRATA.pdf.
[2] 2022 PREPA Fiscal Plan, pp. 151-152.

27. As a general matter, the FOMB's modified net load forecast has the following significance: A higher forecast of future load would mean more electricity sales on which to assess a Legacy Charge, resulting in greater revenues from that Legacy Charge that PREPA could use to support payments on additional New Bonds as creditor recoveries. A higher forecast of future load would also allow PREPA to recover its projected fixed costs through lower non-Legacy-Charge base rates, as the same amount of fixed costs could be spread over more demand. By contrast, a lower forecast of future load would mean lower revenues collected by PREPA from a Legacy Charge, and a need for higher base rates to cover fixed costs.

28. Notably, PREPA *has* a higher forecast of future load than the Base Case the FOMB chose to use in its Legacy Charge model. PREPA's 2022 Fiscal Plan includes an

"Alternative Forecast" of net load that is more realistic and reliable than the Base Case. The Fiscal Plan itself states that the Alternative Forecast is premised on a pace for the future adoption of energy efficiency measures, distributed generation, and electric vehicles that captures the current situation in Puerto Rico, is not constrained by targets in legislation, and incorporates the latest cost data.[14] PREPA's Base Case load forecast, by contrast, assumes as a given that statutory energy-efficiency targets will be met, that installation of distributed generation technologies (like rooftop solar panels) will outpace what is predicted to happen in even the most aggressive and well-funded U.S. jurisdictions, and that there will be zero additional electrical demand from electric vehicles after 2038. PREPA's Alternative Forecast predicts a significantly higher future net load than the Base Case forecast and is the more realistic and only plausible one of the two net load forecasts. The Plan of Adjustment provides no explanation for its use of the Base Case load forecast, rather than the Alternative Forecast, in its Legacy Charge model.

C. PREPA's Gross Load Forecast Predicts Declining Load

29. PREPA's gross load forecast is the starting point for the annual net load forecasts the FOMB relies on in its Legacy Charge Derivation (see **Figure 1** above). PREPA forecasts that its gross load (before any of the adjustments that result in its forecasted net load) will steadily decline over the next three decades.

30. PREPA's annual gross load forecast, for any given fiscal year, is the sum of its monthly gross load forecasts for the residential, commercial, industrial, agricultural, public lighting, and "other" customer categories.[15] Those monthly gross load forecasts are principally

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[14] 2022 PREPA Fiscal Plan, p. 151.

[15] 2022 PREPA Fiscal Plan Model; Responses And Objections Of LUMA Energy, LLC And LUMA Servco, LLC To The Bondholders' Document Requests, *In re: The Financial Oversight and Management Board for Puerto Rico,*

constructed based on separate regression models for the residential, commercial, and industrial sectors.[16]

31. The regression models in the 2022 PREPA Fiscal Plan use different sets of monthly macroeconomic and weather-related historical data as independent variables, including Puerto Rico's real GNP, population, manufacturing employment levels,[17] and temperature measures.[18] To forecast PREPA's gross loads for fiscal years 2023-2051, the regression models rely on forecasts of those explanatory variables (that is, *forecasted* GNP, *forecasted* population, etc.).[19]

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as a representative of the Commonwealth of Puerto Rico, et al., Debtors, PROMESA Title III No. 17-BK-3283-LTS, and *In re: The Financial Oversight and Management Board for Puerto Rico, as a representative of Puerto Rico Electric Power Authority, Debtor*, PROMESA Title III No. 17-BK-4780-LTS (Jointly Administered), United States District Court for the District of Puerto Rico, San Juan, Puerto Rico, April 12, 2023; LUMA Energy, "Load Forecast FY 2023," June 21, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/06/Load-Forecast-FY-2023_Values-3.xlsx.

[16] Regression analysis is a statistical tool for analyzing historical data and determining the extent to which various combinations of explanatory (or "independent") variables predict values for the outcome (or "dependent") variable, in this case monthly electrical demand by sector. PREPA's regression models were originally developed by Siemens as part of PREPA's 2019 Integrated Resource Plan (hereafter "2019 IRP"). Siemens, "Puerto Rico Integrated Resource Plan 2018-2019," June 19, 2019, Section 3-1, available at https://energia.pr.gov/wp-content/uploads/sites/7/2019/06/IRP2019-Main-Report-REV2-06182019-wERRATA.pdf. The 2022 PREPA Fiscal Plan forecasts future load from the agricultural, public lighting, and "other" sectors as constant daily values, without any regression model.

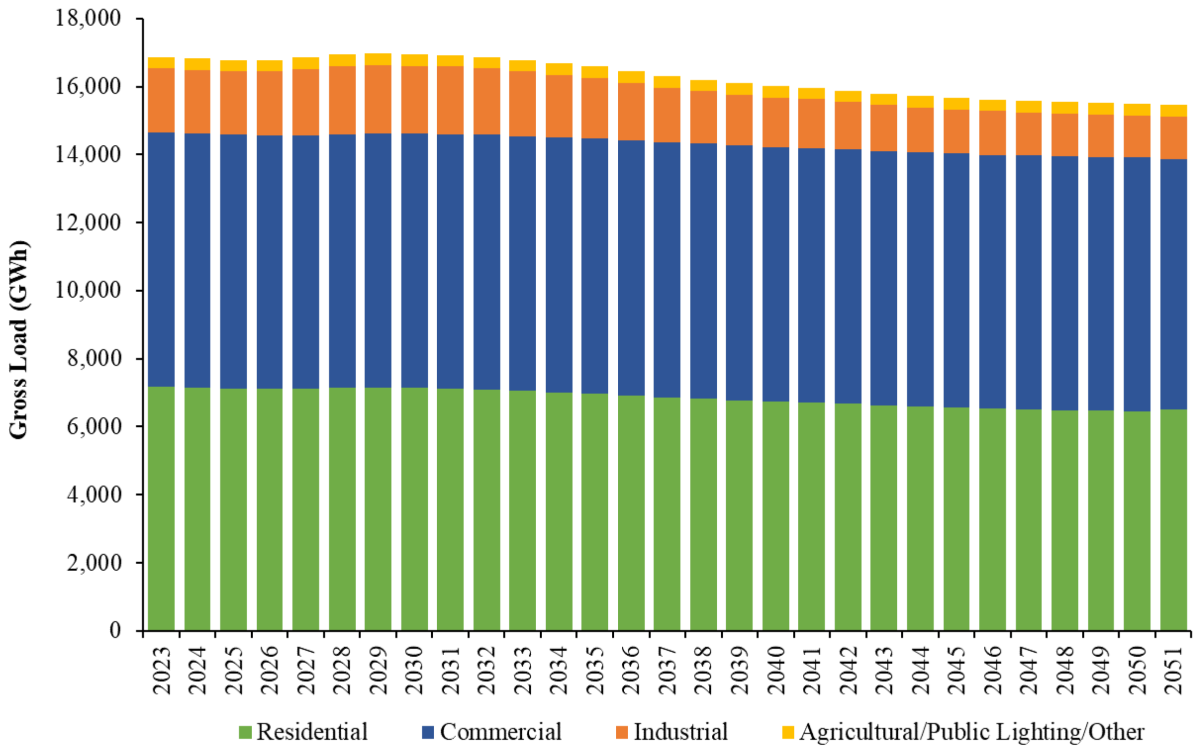
[17] The manufacturing employment series used by PREPA in the gross load forecast was not provided. Therefore, for modified load forecasts, I use the results of PREPA's industrial sector gross load forecast to calculate the implied manufacturing employment series used in PREPA's forecast.

[18] PREPA's regression model uses explanatory variables of a) for residential sector: Cooling degree days (CDD), real GNP, population, and month dummies; b) for commercial sector: CDD, population, and month dummies; c) for industrial sector: CDD, real GNP, manufacturing employment, and month dummies. CDD is a measure of how hot the temperature was during a period of days. Month dummies, also known as indicator variables, have a value of 1 if the observation is in the month represented by the variable and 0 otherwise. LUMA Energy, "Load Forecast FY 2023," June 21, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/06/Load-Forecast-FY-2023_Values-3.xlsx; 2019 IRP.

[19] I provide the annual GNP and population projections underlying the 2022 PREPA Fiscal Plan's gross load forecast as **Appendix C**. Annual GNP and population projections are from the Commonwealth 2022 Certified Fiscal Plan.

Figure 2, which is based on PREPA's 2022 Fiscal Plan model, shows PREPA's gross load forecast by customer type for each fiscal year from FY 2023 through FY 2051.[20] PREPA forecasts an 8.4% total decline in gross load over that period.[21]

Figure 2: PREPA Gross Load Forecast by Customer Type, Fiscal Years 2023-2051



Source:
[1] 2022 PREPA Fiscal Plan Model.

V. PREPA'S NET LOAD FORECAST SIGNIFICANTLY UNDERSTATES FUTURE ELECTRICITY DEMAND

32. In this section, I show that PREPA's Base Case net load forecast, which the FOMB uses in its Legacy Charge model, substantially understates future electricity demand. I begin by discussing the implications of an adjusted gross load forecast, based on Dr. Sebastian

[20] Demand by government agencies is included as part of "Commercial" demand.

[21] PREPA predicts a decline in gross load from 16,870 GWh in FY 2023 to 15,458 GWh in FY 2051. *See* "Revenue Envelope and Legacy Charge_protected.xlsx" (hereafter "Revenue Envelope and Legacy Charge Model").

Edwards's macroeconomic projections. I then demonstrate that the adjustments related to energy efficiency, distributed generation, and electric vehicles that PREPA makes to its gross load forecast to arrive at its Base Case net load forecast are unsupportable.

A. Dr. Edwards's Macroeconomic Projections Imply A Substantially Higher Gross Load Forecast For PREPA

33. As noted above, key inputs in PREPA's gross load regressions include projections of Puerto Rico's growth in real GNP and population. In his expert report, Dr. Sebastian Edwards considers the GNP projections, and prepares two modified projections that have higher GNP relative to the ones underlying the Plan of Adjustment.[22] I understand that one of Dr. Edwards's scenarios is produced using his own economic-growth model for Puerto Rico in combination with population data from the World Bank and that the other scenario is based on macroeconomic projections from the 2022 Commonwealth Fiscal Plan.[23]

34. **Figure 3** shows two adjusted gross load forecasts for FY 2023-2051, premised on incorporating each of Dr. Edwards's two scenarios of macroeconomic projections into PREPA's regression models: (a) Macro Scenario 1, which replaces the GNP projections used in PREPA's existing gross load forecast with Dr. Edwards's projections using a Solow Growth Model for GNP and World Bank population forecasts; and (b) Macro Scenario 2, which replaces the GNP projections used in PREPA's gross load forecast with the baseline GNP forecast from the 2022 Commonwealth Fiscal Plan Economic Outlook Model (including a COVID-19 income adjustment), as discussed in Dr. Edwards's report.[24] **Figure 3** also compares those two

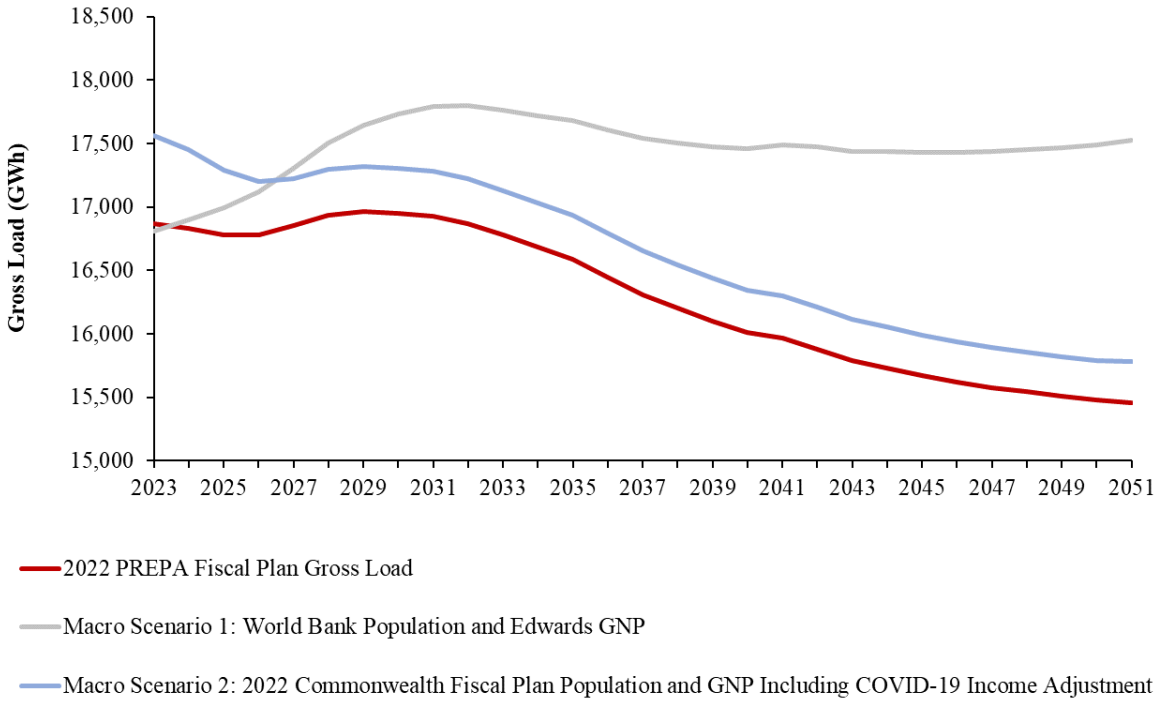
[22] Edwards Report, Sections IV.F and V.B.3.

[23] Edwards Report, Sections IV.F and V.B.3.

[24] Edwards Report, Sections IV.F and V.B.3. and Appendix C.

Edwards-adjusted gross load forecasts to PREPA's existing gross load forecast (which, again, forms the basis for the modified net load forecast on which the FOMB's Legacy Charge Derivation relies).

Figure 3: Forecasts of PREPA Gross Loads With Alternative Macroeconomic Inputs, Fiscal Years 2023-2051



Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] Edwards Report, Appendix C.

35. I calculate that, using Dr. Edwards's modified projections as new inputs into PREPA's regression models (while keeping the rest of those models constant) produces gross load forecasts for fiscal years 2023-2051 that are between 2.3% to 7.3% higher, in aggregate across all 29 fiscal years, than PREPA's existing gross load forecast. The gross load forecast under Macro Scenario 1 is approximately the same at the beginning of the forecast period and 13.4% higher at the end of the forecast period. The gross load forecast under Macro Scenario 2 is

4.1% higher at the beginning of the forecast period and 2.1% higher at the end of the forecast period.

B. PREPA's Base Case Net Load Forecast Significantly Understates Future Electricity Demand By Making Unrealistic, Unsupportable Adjustments To Gross Load

36. FOMB's Disclosure Statement filed March 1, 2023 and the Legacy Charge Derivation state that FOMB relied upon PREPA's Base Case net load forecasts for fiscal years 2023-2051 as a key input for its Legacy Charge model.[25] That Base Case net load forecast starts with PREPA's gross load forecast (discussed above in Section V.A) and adjusts it using "load modifiers" reflecting PREPA's projections of: (i) future load reductions resulting from customers' implementation of energy efficiency measures ("EE");[26] (ii) future load reductions resulting from customers' adoption of distributed generation technologies, primarily rooftop solar panels ("DG");[27] and (iii) future load additions from customers' adoption of electric vehicles ("EVs").[28]

37. **Figure 4** illustrates the combined net effect of these three load adjustments on PREPA's gross load forecast. The resulting Base Case net load forecast estimates that energy efficiency and distributed generation, even after accounting for electric vehicles, will cause electricity demand in Puerto Rico to drop by more than half over the next three decades.

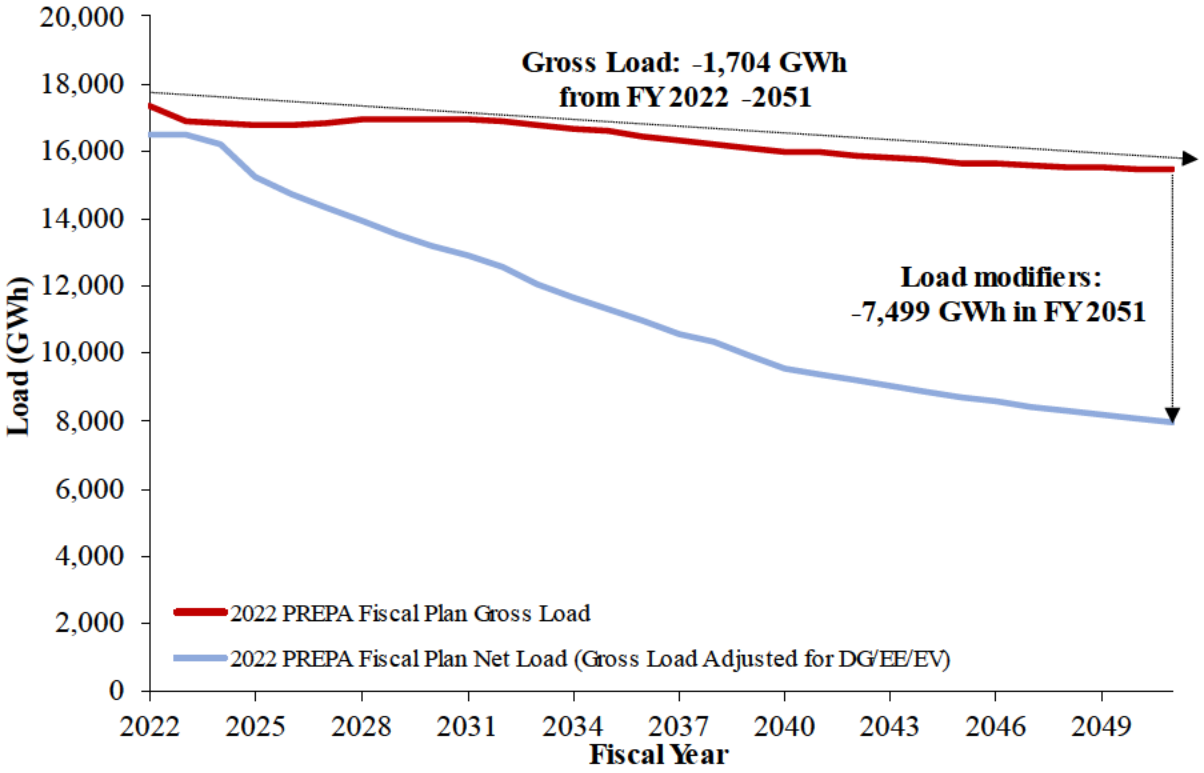
[25] Disclosure Statement; Revenue Envelope and Legacy Charge Model.

[26] 2022 PREPA Fiscal Plan, pp. 147-148.

[27] 2022 PREPA Fiscal Plan, p. 149.

[28] 2022 PREPA Fiscal Plan, p. 150.

Figure 4: Annual Gross and Net Load Forecasts used in Legacy Charge Derivation, Fiscal Years 2022-2051



Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] Revenue Envelope and Legacy Charge Model.

38. More specifically, PREPA forecasts that demand reduction from energy efficiency and distributed generation, net of demand increase from electric vehicles, will reduce load by 7,499 GWh *per year* by FY 2051 to a level only 51% of the unadjusted gross load that PREPA projects for that same year. And that decrease in load comes on top of the projected decrease in gross load discussed above (illustrated by the downward-sloping top line in Figure 4). In sum, PREPA's Base Case net load forecast projects a 51.7% total decrease in load, from 16,492 GWh in FY 2022 down to 7,959 GWh in FY 2051.[29]

39. As discussed below, the three "load modifiers" for energy efficiency, distributed generation, and electric vehicles that PREPA uses to arrive at its Base Case net load forecast are

[29] *See* **Figure 4** Backup.

deeply flawed and unreliable. Their combined effect is to significantly underestimate the volume of PREPA's future electricity sales.

1. PREPA's Base Case Forecast Of Reduced Net Load From Energy Efficiency Is Unreliable And Unreasonable

40. The most significant of the three "load modifiers" that PREPA uses to generate its Base Case net load forecast is the one that predicts a sharp decline in load from customers' rapid adoption of energy efficient technologies. That load modifier takes as its premise that PREPA will achieve a statutory goal of a 30% load reduction by 2040 relative to 2019 levels by implementing robust energy efficiency programs. As I describe below, that is an unreliable way to forecast load reductions from energy efficiency, and in this instance, it leads to an unsupportable and unrealistic result. Indeed, PREPA's own "Alternative Forecast" of energy efficiency adoption, which it based on a bottom-up analysis of actual data instead of assumption of statutory targets, results in a substantially smaller load reduction—and thus a higher net load forecast—than the base case the FOMB uses to determine its proposed Legacy Charge.

41. In 2014, Puerto Rico enacted the Energy Transformation and RELIEF Act, which directed PREPA, as now overseen by the Puerto Rico Energy Board ("PREB"), to achieve a 30% load reduction through energy efficiency programs by 2040.[30] In 2019, Puerto Rico enacted the Puerto Rico Energy Public Policy Act, also known as "Act 17," which reconfirmed that energy efficiency goal.[31]

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[30] *See* Office of Management and Budget, Puerto Rico Energy Transformation and RELIEF Act, Act No. 57 of May 27, 2014, as amended, Section 6.29B — Energy Efficiency (codified as 22 L.P.R.A. § 1054bb-2), available at https://bvirtualogp.pr.gov/ogp/Bvirtual/leyesreferencia/PDF/2-ingles/57-2014.pdf.

[31] Office of Management and Budget, Puerto Rico Energy Public Policy Act, Act. No. 17 of April 11, 2019 (hereafter "Puerto Rico Energy Public Policy Act" or "Act 17"), available at https://bvirtualogp.pr.gov/ogp/Bvirtual/leyesreferencia/PDF/2-ingles/17-2019.pdf. In 2022, PREB issued regulations

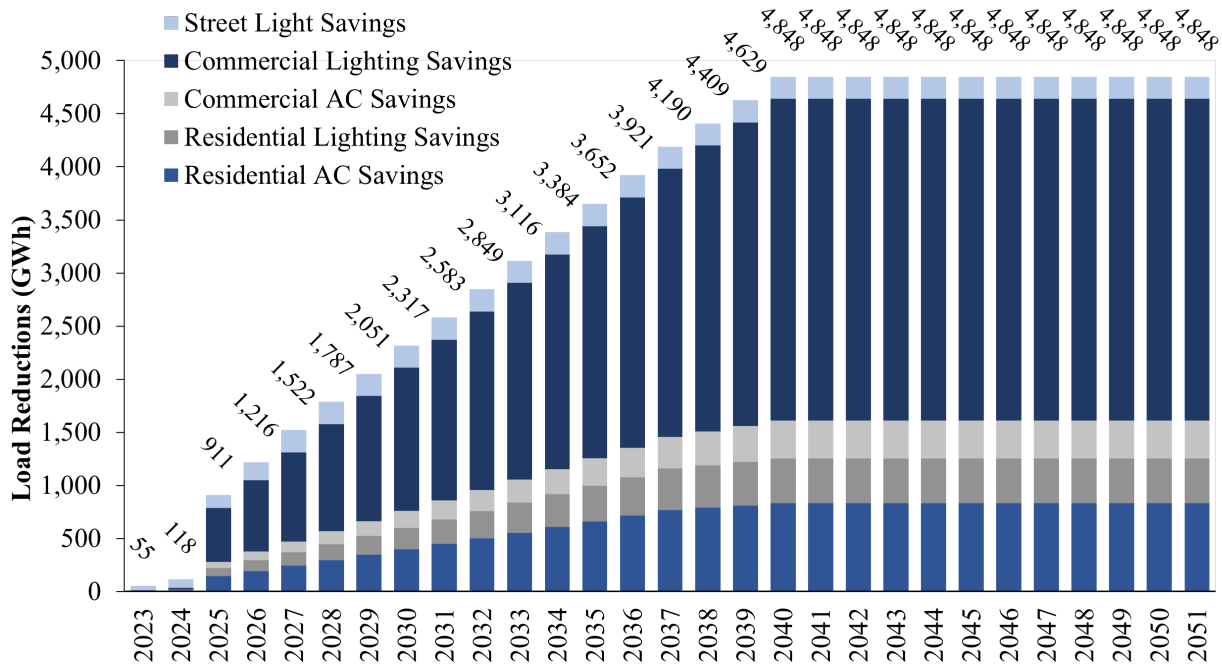
42. As PREPA explains in its 2022 Fiscal Plan, its Base Case load modifier forecast for energy efficiency just takes as a given, rather than supports with evidence, that PREPA will meet that 30% load reduction target—and will do so right on time. It calls these "Act 17 compliant projections."[32] In my opinion, that is an unreliable way for an electric utility to engage in load forecasting for business purposes. Rather than building out a forecast based on reasonable projections from the best available data, PREPA and FOMB instead start with the conclusion—achievement of a 30% load reduction by 2040—and then "forecast" a line for getting from here to there.

43. **Figure 5** shows this base case prediction for PREPA's achievement of Act 17-compliant load reductions from energy efficiency during the FY 2023 – FY 2051 forecast period.

clarifying that the baseline for this 30% reduction goal was FY 2019 electricity sales. PREB, Regulation for Energy Efficiency, Article 3, Energy Efficiency Savings Targets, March 25, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/04/Reglamento-9367-Regulation-for-Energy-Efficiency.pdf.

[32] 2022 PREPA Fiscal Plan, p. 148.

Figure 5: 2022 PREPA Fiscal Plan Base Case Energy Efficiency Forecast: Cumulative Energy Efficiency Savings Goals By Program Fiscal Years 2023-2051



Source:
[1] 2022 PREPA Fiscal Plan Model.

44. A notable feature of this forecast—and indicative of its ends-driven approach—is the "elbow" at fiscal year 2040. The Base Case projects rapid increases in annual load reductions from energy efficiency through 2040—in time for the 30% reduction target stated in Act 17 to be achieved—but then predicts no further load reductions from energy efficiency for *eleven years* thereafter. In other words, the forecast assumes that large, annual load reductions will occur per the schedule stated in Act 17, after which no more load reduction will be provided by increasing energy efficiency.

45. None of this is based upon evidence of what energy-efficiency gains can and will actually be achieved in Puerto Rico. To the contrary, the scenario reflected in the Base Case is implausible. Achieving PREPA's energy efficiency forecast would require the widespread, rapid adoption of energy-efficient technologies (e.g., lighting, air conditioning, appliances) by multiple

types of customers (residential, commercial, industrial, etc.). In my experience, this would necessitate large-scale private investments and government subsidies and programs that do not currently exist in Puerto Rico. In fact, as PREPA acknowledges in the 2022 PREPA Fiscal Plan, "To date, there is […] no implementation or financing plan in place that would be typical for energy efficiency programs with targets of this scale, and it is unclear how energy efficiency measure[s] will be implemented or how much impact on load such measures will have."[33] PREB also acknowledged last year that there "have never been extensive utility-run energy efficiency programs in Puerto Rico."[34]

46. LUMA, as PREPA's transmission-and-distribution system operator, is developing a series of "Transition Period" energy efficiency programs and incentives in an attempt to overcome existing barriers to consumers' adoption of energy efficiency.[35] LUMA foresees a two-year transition period, in fiscal years 2023 and 2024, during which LUMA predicts that its initial energy-efficiency programs will generate some limited load reductions. But these cumulative reductions amount to only 17 GWh in FY 2023 and 41 GWh in FY 2024. Those projected reductions are two-thirds lower (69% and 65%, respectively) than the energy-efficiency load reductions that PREPA's Base Case assumes for FY 2023 and FY 2024.[36] And PREB concedes that the "size and scope of Puerto Rico's energy efficiency programs will be

[33] 2022 PREPA Fiscal Plan, p. 74.

[34] PREB, "Request for Proposals: Energy Efficiency Baseline and Potential Studies," April 27, 2022 (hereafter "PREB Request for Proposals"), p. 5, available at https://static1.squarespace.com/static/61ea784947109b1572ec37ec/t/627cca4e2ddcae3086a1faf5/1652345423614/NEPR+EE+Study+RFP+revised.pdf.

[35] *See* LUMA Energy, "Transition Period Program Plan for Energy Efficiency and Demand Response," June 21, 2022 (hereafter "LUMA Transition Period Program Plan"), available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/06/Motion-Submitting-Proposed-EE-DR-Transition-Period-Plan-NEPR-MI-2021-0006.pdf.

[36] *See* **Table 1**. 69% and 65% are given by the ratio of 2022 LUMA Transition Period Plan predictions to the 2022 Fiscal Plan predictions for 2023 and 2024, respectively.

limited by practical considerations of program launch and scale-up during the next five years."[37] PREPA's Base Case projection of energy-efficiency gains is also implausible in light of the fact that Puerto Rico has less-well-developed energy efficiency programs backed by government funding than exist in other U.S jurisdictions. In 2018, the American Council for an Energy Efficient Economy ("ACEEE") assigned a 15% score out of 100% to Puerto Rico's energy efficiency programs and initiatives, which ranks it near the bottom of other U.S. states.[38]

47. It is therefore not surprising to me that PREPA has repeatedly failed to meet its inflated forecasts for energy efficiency. PREPA's 2020 Fiscal Plan estimated 303 GWh of cumulative savings from energy efficiency by FY 2022. Just one year later, PREPA's 2021 Fiscal Plan had cut that FY 2022 estimate to zero. Likewise, PREPA's 2020 Fiscal Plan estimated 607 GWh in cumulative savings by FY 2023—an amount that was cut in half to 303 GWh in the 2021 Fiscal Plan, and then down to 55 GWh in the 2022 Fiscal Plan.[39] PREPA thus has repeatedly demonstrated it is not capable of accomplishing the load reduction from energy efficiency that is predicted by its Base Case forecast. In fact, the 2019, 2020, 2021, and 2022 Fiscal Plans each show that PREPA has made virtually no progress on the Act 17 target on which the Base Case forecast relies. **Table 1** shows the forecasts of energy efficiency in PREPA's Fiscal Plans from 2020 through 2022, along with estimates from LUMA's latest Transition Period Program Plan.

[37] PREB Request for Proposals, p. 9.

[38] ACEEE, "Puerto Rico," July 20, 2018, available at https://database.aceee.org/territory/puerto-rico; ACEEE, "2018 State Energy Efficiency Scorecard," October 4, 2018, available at https://www.aceee.org/research-report/u1808.

[39] *See* Table 1.

Table 1: Fiscal Plan Estimates of Cumulative Savings from Energy Efficiency Programs: PREPA Fiscal Plans for FY 2020, FY 2021, and FY 2022 and LUMA Transition Period Program Plan

	Forecast Source			
Cumulative Savings Relative to 2019 Estimated to be Achieved by:	2020 PREPA Fiscal Plan	2021 PREPA Fiscal Plan	2022 PREPA Fiscal Plan	2022 LUMA Transition Period Plan
FY 2022	303 GWh	0 GWh	–	–
FY 2023	607 GWh	303 GWh	55 GWh	17 GWh
FY 2024	911 GWh	607 GWh	118 GWh	41 GWh
FY 2025	1,216 GWh	911 GWh	911 GWh	–

Sources:
[1] "FOMB - June 2020 PREPA CFP Model_vS.03.xlsx," FOMB_PREPA 00024556 (hereafter "2020 PREPA Fiscal Plan Model").
[2] "FOMB - May 2021 FP Model_Data_Room_vF2.xlsx," FOMB_PREPA 00020362 (hereafter "2021 PREPA Fiscal Plan Model").
[3] 2022 PREPA Fiscal Plan Model.
[4] LUMA Transition Period Program Plan, p. 10.

48. Last year, PREPA effectively conceded that its Base Case forecast of load reduction from energy efficiency is unreliable. PREPA's 2022 Fiscal Plan states that because its Act 17 compliance projections "are based on optimistic assumptions regarding participation rates and savings potential, the observed impact of such measures might be lower."[40] In fact, PREPA's 2022 Fiscal Plan states clearly that "assumptions in the Base Case do not fully capture the actual constraints and realities in Puerto Rico or the state of current programs and plans in place to support these assumptions."[41]

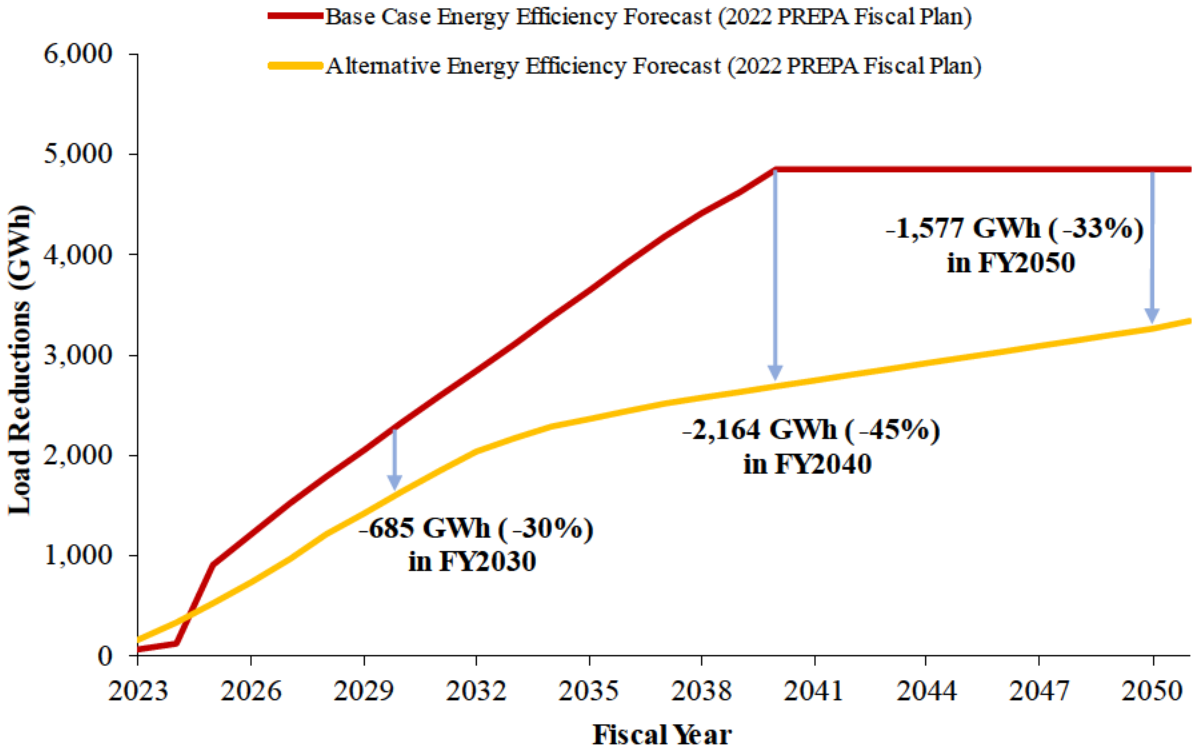
49. The 2022 PREPA Fiscal Plan therefore presents an "Alternative Forecast" projection of load reductions from energy efficiency (and other load modifiers) that, unlike the Base Case, this Alternative Forecast is based upon a ground-up analysis of data and trends. The Alternative Forecast shows lower load reductions (and thus higher net load) for every year after 2024, as shown in **Figure 6**. In particular, it shows load reductions from energy efficiency that

[40] 2022 PREPA Fiscal Plan, p. 148.

[41] 2022 PREPA Fiscal Plan, p. 151.

are 30% lower than the Base Case in fiscal year 2030, 45% lower in fiscal year 2040, and 33% lower in fiscal year 2050.[42]

Figure 6: 2022 PREPA Fiscal Plan Base Case and Alternative Forecast for Energy Efficiency, Fiscal Years 2023-2051



Note:
[1] For the Alternative Forecast, I extrapolate 2051 load reduction values using the Alternative Forecast growth rates between 2049 and 2050 by forecast subcomponent.
Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] 2022 PREPA Fiscal Plan Alternative Forecast Model.

50. For reasons that are not explained, however, the Alternative Forecast is ignored in the 2022 Fiscal Plan in favor of the unsupported Base Case forecast. I note that even the alternative energy efficiency forecast has flaws that are biased toward a quicker adoption of energy efficiency than is reasonable to expect in Puerto Rico. For example, PREPA's

[42] PREPA's Alternative Forecast only has projections of load modifiers through 2050. For each of energy efficiency, distributed generation, and electric vehicles, I extrapolate 2051 load adjustment values using the Alternative Forecast growth rates between 2049 and 2050 by forecast subcomponent.

Alternative Forecast assumes *100%* customer adoption, each replacement cycle, of all modeled energy efficient non-lighting technologies (such as household appliances).[43] And PREPA acknowledges that this models a best-case scenario of "maximum technical reduction in load due to EE" from such adoption.[44] But even with that and other flaws, it is my opinion that PREPA's Alternative Forecast, unlike the Base Case forecast, at least comports in broad strokes with basic principles of forecasting future outcomes based on the best available data.

2. PREPA's Base Case Forecast Of Reduced Net Load From Distributed Generation Is Unsupported

51. PREPA's Base Case net load forecast is further altered unreliably by its unsupported assumption that Puerto Rico will make unprecedented gains in customers' installation of distributed generation facilities, which would reduce demand for electricity from the grid. PREPA assumes that this distributed generation will largely occur through the adoption of rooftop solar panels by residential, commercial, and industrial customers, and growth in the use of combined heat and power ("CHP") technologies by industrial customers. PREPA reports that its Base Case forecast for the use of distributed generation is based on the methodology used in PREPA's 2019 Integrated Resource Plan.[45] That Base Case forecast starts with actual

[43] "PREPA 2022 FP Alternative Forecast.xlsx", FOMB_PREPA 00003022 (hereafter "2022 PREPA Fiscal Plan Alternative Forecast Model"), tab "EE Inputs."

[44] 2022 PREPA Fiscal Plan Alternative Forecast Model, tab "EE Inputs."

[45] The 2022 PREPA Fiscal Plan notes that "[d]eployment of distributed generation (i.e., rooftop solar and combined heat and power generation) is expected to grow and is projected based on the same methodology used for the IRP [2019 Integrated Resource Plan]." The 2019 IRP estimate of growth in customer-sited generation was based on historical trends as of 2018, which were then carried forward into future years. The 2022 PREPA Fiscal Plan also assumes growth in CHP in the industrial sector and notes "[t]he assumptions for CHP are based on customer survey and data gathering used in the IRP and updated by PREPA Planning and T&D personnel." *See* 2022 PREPA Fiscal Plan, p. 149; Siemens, "Puerto Rico Integrated Resource Plan 2018-2019 Appendix 4: Demand Side Resources," pp. 3-19, available at https://aeepr.com/es-pr/QuienesSomos/Ley57/Plan%20Integrado%20de%20Recursos/IRP2019%20-%20Ex%201.04%20-%20%20Appendix%204%20-%20Demand%20Side%20Resources.pdf.

distributed generation output of 864 GWh in FY 2022, and predicts that output will increase nearly fivefold, to 4,298 GWh, by FY 2051.[46]

52. Those assumptions far outstrip any reliable forecast of what is reasonable to expect in view of the constraints on such adoption and the actual experience of other jurisdictions, including jurisdictions with more favorable economic environments for catalyzing such alternative energy progress.

53. PREPA also has prepared an Alternative Forecast of distributed generation. But as with PREPA's Alternative Forecast of energy efficiency gains, PREPA's Alternative Forecast is ignored by the Plan of Adjustment in favor of the Base Case forecast. Unlike the Base Case forecast, the Alternative Forecast relies upon specific forecasts of distributed solar generation adoption by residential, commercial, and industrial customers which appear to be developed from estimates of distributed generation system costs and the incremental economic benefits to adopters from electricity bill savings.[47]

54. The Alternative Forecast also assumes that, consistent with Puerto Rico law, PREPA and PREB will soon consider reforms to the "net metering" program that determines the amount of any monetary credit customers receive for distributed-generated electricity they sell back to the grid.[48] PREPA's Alternative Forecast assumes that Puerto Rico's post-2024 net

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[46] 2022 PREPA Fiscal Plan Model.

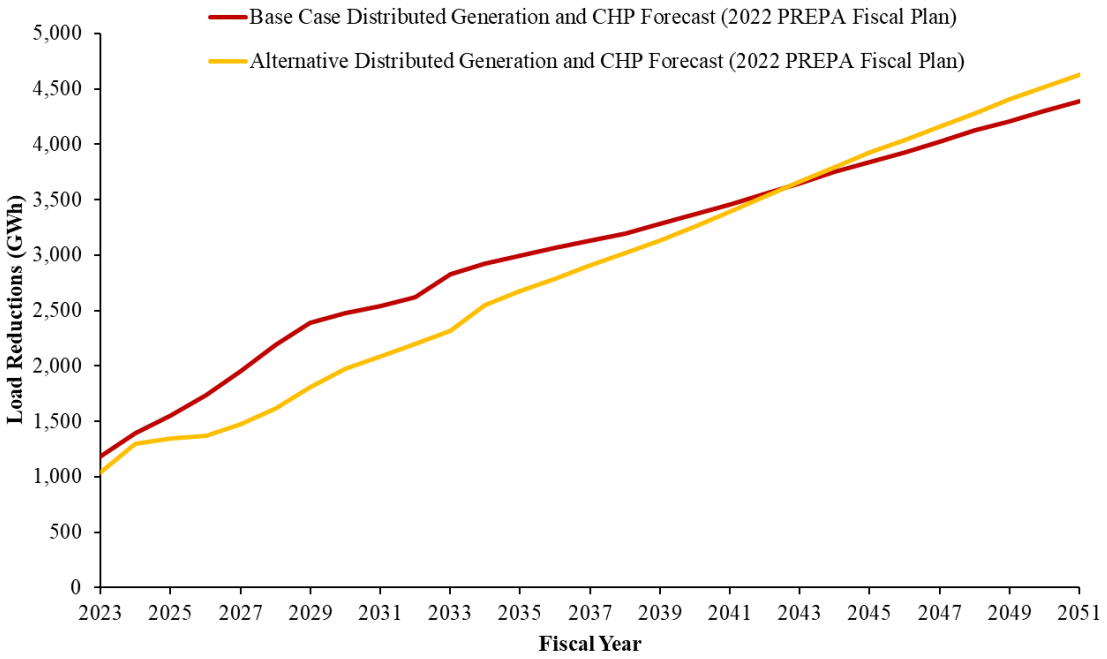
[47] The Alternative Forecast uses NREL 2020 Annual Technology Baseline (ATB) estimates of installation and O&M costs for rooftop solar over time, assuming that Puerto Rico will face a 16% higher DG installation cost compared to the US mainland due to various logistical constraints. The Alternative Forecast does not re-estimate the forecast of CHP in the industrial sector. *See* 2022 PREPA Fiscal Plan, p. 153.

[48] Currently, under the net metering program, customers with small distributed generation installations are compensated at 100% of the retail electricity rate for excess generation produced by the equipment and not used by the customer. DSIRE, "Puerto Rico – Net Metering," October 12, 2021, available at https://programs.dsireusa.org/system/program/detail/2846/puerto-rico-net-metering.

metering policy will avoid overpaying new net metering customers for power generated by rooftop solar panels and other distributed generation.[49]

55. **Figure 7** shows PREPA's Base Case and Alternative Forecasts for distributed generation (including CHP). Generally speaking, the Base Case forecast predicts faster adoption in the earlier years of the FY2023-2051 period, whereas the Alternative Forecast starts out slower but ultimately ends up with higher levels of load reductions.

Figure 7: 2022 PREPA Fiscal Plan Base Case and Alternative Distributed Generation and CHP Forecasts, Fiscal Years 2023-2051



Notes:
[1] Both PREPA forecasts include the load reduction from industrial Combined Heat and Power ("CHP"). The forecast for CHP is identical between the Base Case and Alternative forecasts.
[2] For the Alternative Forecast, I extrapolate 2051 load reduction values using the Alternative Forecast growth rates between 2049 and 2050 by forecast subcomponent.
Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] 2022 PREPA Fiscal Plan Alternative Forecast Model.

[49] 2022 PREPA Fiscal Plan, p. 154.

56. In my opinion, the ground-up methodology used by the Alternative Forecast, and its more reasonable assumptions about future net metering policies, is the only one that is consistent with estimation methodology typically employed by other large public electricity utilities. But both forecasts, in my view and based on my experience, are unreasonably optimistic about the pace at which customers can be expected to adopt distributed generation.

57. In both the Base Case and Alternative Forecast, most of the predicted distributed generation capacity would come in the form of new rooftop solar generation, and most of that is expected to be installed by residential customers.[50] But there are a number of substantial barriers to Puerto Rico households' installation and use of solar generation systems that would need to be overcome, and whose impacts are understated in PREPA's forecasts.

58. First, residential distributed solar systems are expensive. The Solar Foundation observes that the "upfront capital expenditure to purchase and install solar panels, inverters, balance of system equipment, racking systems, and storage is too steep an entry point for most individuals and families" in Puerto Rico.[51] Based on cost and average system size assumptions made by PREPA's Alternative Forecast, the average cost of a new residential photovoltaic ("PV") system in fiscal year 2023 would be at least $13,702.[52] That would be a substantial burden for most households in Puerto Rico. Moreover, the up-front cost for solar installations in

[50] *See* 2022 PREPA Fiscal Plan Model; 2022 PREPA Fiscal Plan Alternative Forecast Model.

[51] The Solar Foundation, "Finance Report: An Assessment of Opportunities and Barriers to Solar Finance in Puerto Rico," April 2021, p. 13, available at https://irecusa.org/wp-content/uploads/2021/07/FinanceReport-Completed_5-13.pdf.

[52] $13,702 is $2,635 per kW "Installed Cost post-ITC" multiplied by the assumed "running average PV system size" of 5.2 kW (the average of 4.8kW from the 2022 PREPA Fiscal Plan Alternative Forecast Model "High Adoption" tab and 5.6kW from the "Low Adoption" tab). The "post-ITC" cost assumes that the household customer is eligible for a 22% federal investment tax credit. PREPA's projected "Installed Cost" without the ITC credit is $3,378/kW, which implies a total system cost of $17,566. *See* 2022 PREPA Fiscal Plan Alternative Forecast Model, tabs "Low Adoption", "High Adoption", "Model – Low", "Model – High."

U.S. states is partially defrayed by a federal investment tax credit ("ITC") for distributed solar (which as of 2023, provides a credit of 30% of solar equipment and installation costs).[53] But U.S. federal income tax does not apply to Puerto Rico income, and so most households do not have a federal tax liability to offset with this non-refundable tax credit.[54] Solar financing to residential customers could offset some up-front costs to households, but those options remain limited because, among other things, "[s]olar financing is not advertised nor marketed aggressively by any of the coops, traditional banks, or federal credit unions in Puerto Rico" and PREB has raised legal issues with power purchase and lease financing agreements.[55]

59. Second, there are operational barriers to distributed solar installations. The Alternative Forecast assumes that 85% of all residential customers have access to rooftops suitable for solar panel adoption, based on a NREL study.[56] But the Alternative Forecast confuses technical potential (which analyzes the suitability of technology adoption based on things like having a large enough surface with an unobstructed line of sight to the sun for a sufficient portion of the day) with economic and logistical feasibility or viability. In short, the percentage of suitable rooftops is not the same as the percentage of eligible customers who can

[53] Solar Energy Technologies Office, "Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics," March 2023, available at https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics.

[54] IRS, "Topic No. 901, Is a Person with Income from Puerto Rico Required to File a U.S. Income Tax Return?" April 7, 2023, available at https://www.irs.gov/taxtopics/tc901. According to the Energy Department the federal tax credit for solar PV "is a nonrefundable tax credit, which means you will not get a tax refund for the amount of the tax credit that exceeds your tax liability." Solar Energy Technologies Office, "Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics," March 2023, available at https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics.

[55] The Solar Foundation, "Finance Report: An Assessment of Opportunities and Barriers to Solar Finance in Puerto Rico," April 2021, p. 14, available at https://irecusa.org/wp-content/uploads/2021/07/FinanceReport-Completed_5-13.pdf.

[56] 2022 PREPA Fiscal Plan Alternative Forecast Model, tab "NREL"; NREL, "Puerto Rico Low-to-Moderate Income Rooftop PV and Solar Savings Potential," December 17, 2020, available at https://www.nrel.gov/docs/fy21osti/78756.pdf.

feasibly (and legally) install solar panels on those roofs. For example, in 2021, over 30% of Puerto Rico's households were renters who cannot unilaterally decide to install rooftop solar panels on their landlords' roofs.[57] Moreover, residents of multi-story apartment complexes or condos may live in buildings with suitable roofs but would face multiple constraints to installing rooftop solar panels on those buildings. Accordingly, significantly fewer than 85% of all residential customers would realistically be able to adopt distributed solar, even leaving aside the economic barriers.

60. Finally, the kind of substantial, increased deployment of distributed generation modeled by PREPA's forecasts would likely require PREPA to make significant investments in its grid infrastructure to accommodate the injection of such decentralized power supply on a reliable basis.[58] The effects of distributed generation on local grids can be location-specific, sometimes imposing substantial costs and operational challenges for the system, such as voltage control, power quality, advanced communications, power electronics, and management of energy imbalances across different distribution circuits.[59] PREPA does not yet have deep experience integrating high-penetration levels of distributed generation into its system, and its net load

[57] The owner-occupied housing unit rate is 68.0%. US Census, "QuickFacts Puerto Rico," available at https://www.census.gov/quickfacts/fact/table/PR/HSG445221.

[58] *See*, *for example*, National Academies of Sciences, Engineering and Medicine, *The Future of Electric Power in the U.S.*, The National Academies Press, 2021, available at https://doi.org/10.17226/25968. (As a member of the NASEM Committee on the Future of Electric Power, I am a co-author of this report.) *See also* Tierney, Susan, "The Value of 'DER' to 'D': The Role of Distributed Energy Resources in Supporting Local Electric Distribution System Reliability," *Analysis Group*, March 31, 2016, available at https://www.analysisgroup.com/globalassets/content/news_and_events/news/value_of_der_to-_d.pdf.

[59] *See* Razavi, Seyed-Ehsan, et al. "Impact of Distributed Generation on Protection and Voltage Regulation on Distribution Systems: A Review," *Renewable and Sustainable Energy Reviews*, Vol. 105, May 2019, available at https://www.sciencedirect.com/science/article/abs/pii/S1364032119300668.

forecasts underestimate that practical limitation on the reasonable pace of future rooftop solar adoption.[60]

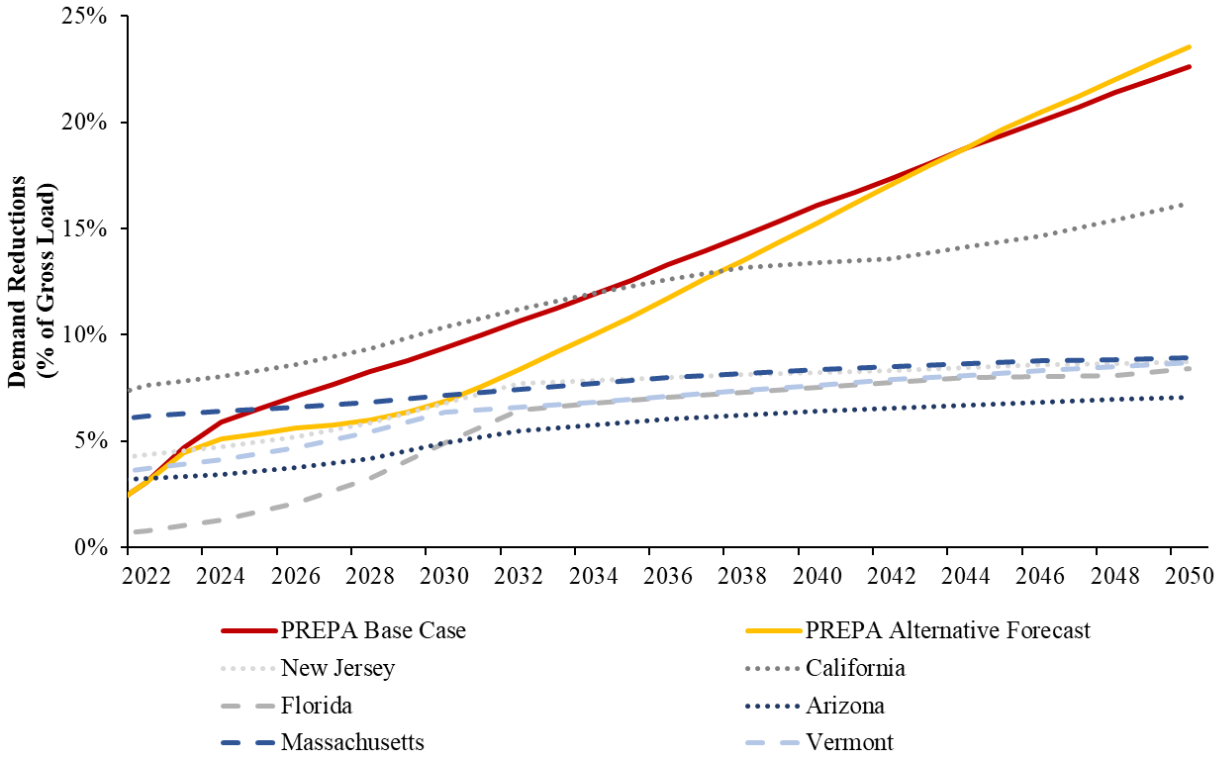
61. The result of making these aggressive and unsupported assumptions about residential solar adoption is that PREPA's Base Case and Alternative Forecast both assume much greater growth of distributed generation than is reasonable to expect in Puerto Rico, or even in states with much more experience and governmental funding to support distributed generation adoption. **Figure 8** compares PREPA's Base Case and Alternative Forecast of distributed solar generation to NREL's mid-case scenario forecasts for U.S. states with the *highest* levels of predicted load reduction from distributed solar generation between 2020 and 2050.[61] Each of these states have higher median household incomes than Puerto Rico.[62] Although my experience leads me to expect that Puerto Rico's pace of solar adoption should be *slower* than these states, PREPA's forecasts predict that Puerto Rico pace of adoption will, by 2037, *surpass* even these leading states—and, indeed, *all* states in the contiguous U.S. That is unrealistic and unsupported.

[60] NREL observes a "[l]ack of knowledge, understanding, and experience" as an issue for the integration of distributed energy resource integration in Puerto Rico. Narang, David, et al., "Considerations for Distributed Energy Resource Integration in Puerto Rico," NREL, February 2021, p. vii, available at https://www.nrel.gov/docs/fy21osti/77127.pdf.

[61] NREL, "Mid-Case Scenario," *State and Local Planning for Energy*, available at https://maps nrel.gov/slope/data-viewer?layer=standard-scenarios mid-re-cost&res=state&year=2020&filters=%5B%5D. The Mid-Case scenarios for other states are based on (i) electricity demand growth and natural gas prices from the Annual Energy Outlook 2020 Reference scenario, (ii) Mid-case technology, battery storage, and finance (20-year capital recovery period) cost projections from the 2020 Annual Technology Baseline, (iii) reference retirements (*i.e.,* the model retires plants when they reach a specified lifetime or if their revenues are not sufficient to cover their costs), and (iv) current law (*i.e.,* state, regional, and federal energy policies as of May 31, 2020). NREL does not predict power system evolution in Hawaii or Alaska.

[62] US Census, *2017-2021 American Community Survey 5-year Estimates*, available at https://data.census.gov/table?q=median+household+income+california&g=040XX00US04,06,12,15,25,34,50,72&tid=ACSST5Y2021.S1903.

Figure 8: Distributed Solar Generation Forecast from 2022 PREPA Fiscal Plan Compared to NREL Mid-Case Forecasts for Other U.S. States



Notes:
[1] Distributed solar generation data are provided by NREL every 2 years starting in 2018.
[2] The PREPA forecasts of distributed generation exclude CHP for the industrial sector.
[3] Distributed generation data from the Alternative Forecast is replaced with historical data from the 2022 Fiscal Plan for the years before 2023.
[4] For the Alternative Forecast, I extrapolate 2051 load reduction values using the Alternative Forecast growth rates between 2049 and 2050 by forecast subcomponent.
Sources:
[1] NREL, "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, 2019, https://maps nrel.gov/slope.
[2] NREL Data Viewer, "Mid-Case Scenario," State and Local Planning for Energy, 2020, https://maps nrel.gov/slope.
[3] 2022 PREPA Fiscal Plan Model.
[4] 2022 PREPA Fiscal Plan Alternative Forecast Model.

62. For example, PREPA surprisingly—and implausibly—forecasts that Puerto Rico's distributed solar adoption will outpace California, a historical leader in distributed solar adoption. But there are important differences between the two: California has substantially

higher median income than households in Puerto Rico,[63] and unlike Puerto Rico, California has state-mandated policies supporting consumer adoption of rooftop solar. California began its California Solar Initiative back in 2007, which included significant funding for low-income households to install solar equipment through the Single Family Affordable Solar Homes program.[64] One of California's major electric utilities testified that "since 2008, the CPUC [California Public Utilities Commission] has adopted $2 billion in funding for [solar] programs with approximately $1.3 billion remaining to be spent through 2038."[65] Puerto Rico would need to make an extraordinary and unprecedented investment in support for distributed solar generation to cause the kind of huge gains in adoption rates over the next decade that would even approach California's level of progress, much less to surpass it.

63. While both are flawed, the Alternative Forecast of adoption of distributed generation, as compared to the Base Case forecast, provides an estimation methodology more consistent with typical forecasting practice. But both forecasts significantly overstate the likely pace of adoption of distributed generation, and therefore understate likely net load in the future.

[63] In 2021, the Census reported that median household income was $84,097 in California. By contrast, in 2021 median household income was only $21,967 in Puerto Rico. US Census, *2017-2021 American Community Survey* 5-year Estimates, available at https://data.census.gov/table?q=median+household+income+california&g=040XX00US04,06,12,15,25,34,50,72&tid=ACSST5Y2021.S1903.

[64] California Public Utilities Commission, "About the California Solar Initiative," available at https://www.cpuc.ca.gov/-/media/cpuc-website/about-cpuc/documents/transparency-and-reporting/fact_sheets/csifactsheet_v4.pdf.

[65] Three quarters of the funding is from the proceeds California receives as revenues in the sale of GHG emission allowances in its cap-and-trade-program. Joint Opening Testimony of Southern California Edison Company, Pacific Gas and Electric Company and San Diego Gas & Electric Company before the California Public Utilities Commission, R.20-08-020 Order Instituting Rulemaking to Revisit Net Energy Metering Tariffs Pursuant to Decision 16-01-044, and to Address Other Issues Related to Net Metering, June 18, 2021, p. 166.

3. PREPA's Base Case Forecast Of Additional Net Load From Electric Vehicles Is Arbitrarily Truncated And Understated

64. The Base Case further understates net load by arbitrarily assuming that load growth resulting from increased adoption of electric vehicles will abruptly halt in 15 years. The increased use of electric vehicles tends to increase the future loads on electric utility systems, including PREPA, as the penetration of electric vehicles increases over time. To state the obvious, electric vehicles are recharged by plugging them into an electricity source, instead of by refilling a gas tank. The 2022 PREPA Fiscal Plan observes that "a significant uptake in EV sales will have an impact on electricity demand, both on average and peak load *and has the potential to offset the effect of EE and DG*."[66] PREPA's load forecasts thus acknowledge that increasing use of electric vehicles in Puerto Rico increases electricity demand, all else being equal. PREPA's Base Case forecast assumes load growth in the residential and commercial sectors from the increasing automobile-market penetration of electric vehicles.[67] The Base Case states a forecast of EV demand, and resulting load addition, that is assertedly founded on "basic assumptions of future growth based on historical growth," but the Fiscal Plan provides no evidence for its assumptions.

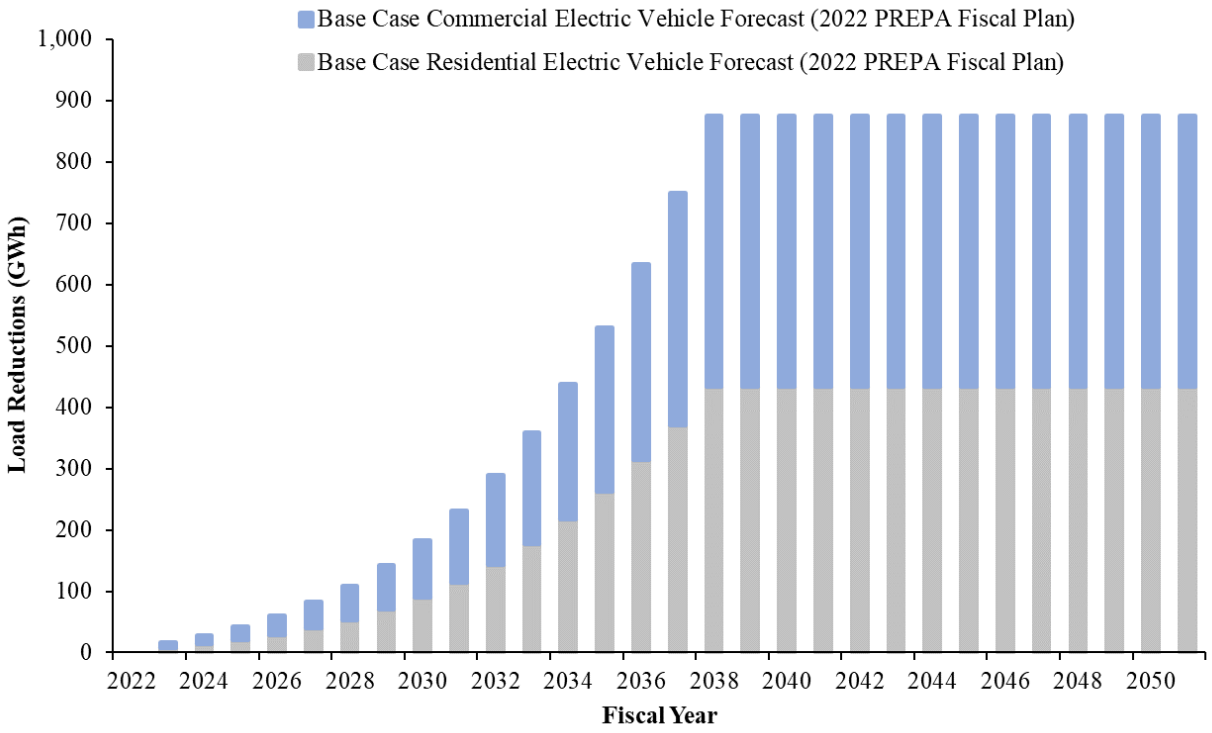
65. As shown in **Figure 9**, PREPA's Base Case assumes unexplained year-to-year incremental additions to electricity load from charging EV batteries. PREPA forecasts those incremental additions to grow from 2022 through 2038, with roughly a doubling of electricity consumption by EVs every five years from 2020 through 2038. Then, starting in 2038, the forecast abruptly switches to predicting *no further increases* in EV-related load. In other words,

[66] 2022 PREPA Fiscal Plan, pp. 150-151.

[67] The 2022 PREPA Fiscal Plan Base Case forecast assumes zero growth in EV load from the industrial or any other sectors.

PREPA's Base Case net load forecast appears to assume that however many EVs are on the streets of Puerto Rico in 2038, the PREPA system will have the same total electric usage by EVs in 2051. This growth-to-no-growth pattern is inexplicable and unsupportable; it is not reasonable to assume that there will be no change in EV consumption from 2038 through 2051.

Figure 9: Electric Vehicle Forecast from 2022 PREPA Fiscal Plan Base Case



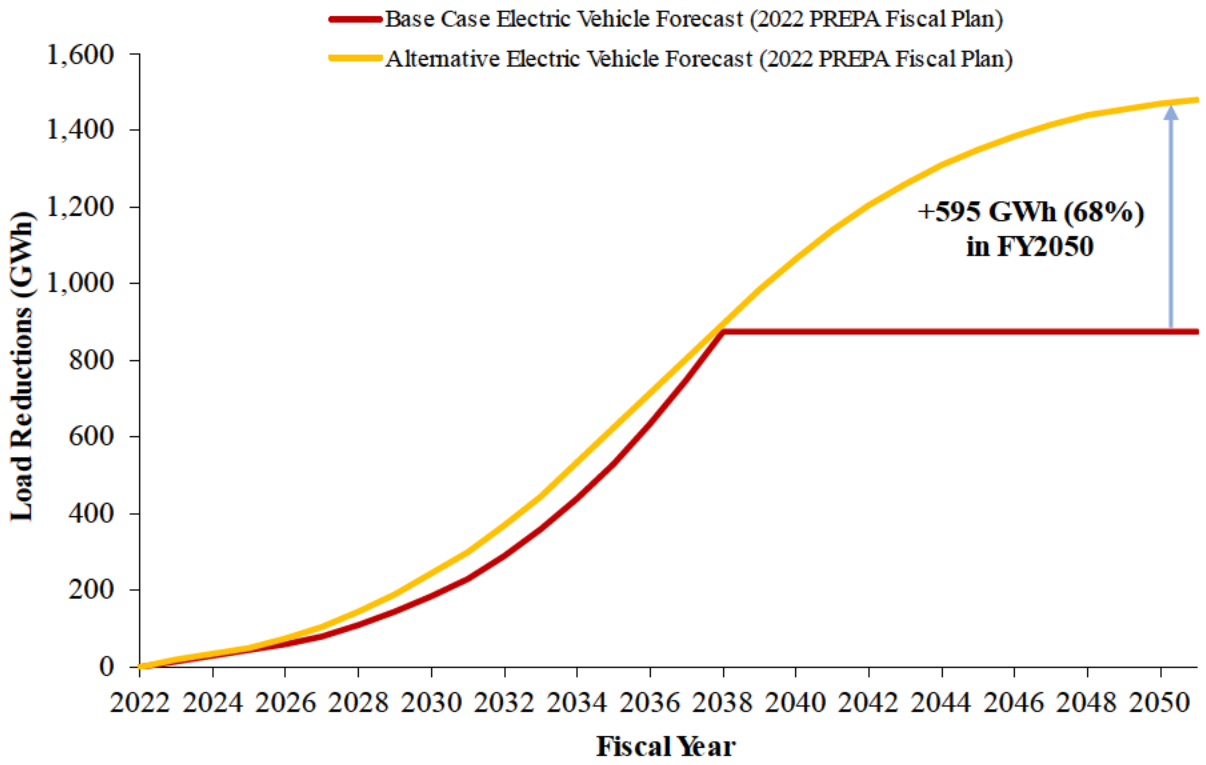
Source:
[1] 2022 PREPA Fiscal Plan Model.

66. Once again, PREPA's Alternative Forecast provides a more reasonable approach than the Base Case EV load forecast. PREPA states that the Alternative Forecast is based on a ground-up projection of the total number of electric vehicles in Puerto Rico over time and takes into account things like an electric vehicle's cost of ownership and Puerto Rico's gasoline prices versus electricity rates. This alternative approach estimates that "33% of cars in Puerto Rico [will be] EVs by 2050," and estimates the corresponding additional electrical demand from these vehicles.[68] I note that, like the Alternative Forecast projection presented for energy efficiency and distributed generation, the Alternative Forecast for the adoption of electric vehicles forecasts *greater* consumption of electricity as compared to the Base Case. That is, what all three alternative load modifier forecasts have in common is that (i) they all project greater demand for electricity than in their respective Base Case forecasts and (ii) none of them are considered in the Plan of Adjustment.

67. **Figure 10** compares the Base Case forecast and Alternative Forecast of EV demand.

[68] 2022 PREPA Fiscal Plan Alternative Forecast.

Figure 10: Electric Vehicle Forecast from 2022 PREPA Fiscal Plan Base Case Compared to Alternative Forecast



Note:
[1] For the Alternative Forecast, I extrapolate 2051 load reduction values using the Alternative Forecast growth rates between 2049 and 2050 by forecast subcomponent.
Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] 2022 PREPA Fiscal Plan Alternative Forecast Model.

68. PREPA's Alternative Forecast is higher than its Base Case forecast in terms of load increases from electric vehicles, although until 2038 those differences are not large. But as **Figure 10** shows, the difference becomes pronounced beginning in 2038. The Base Case uses an arbitrary temporal cut-off, and it forecasts no further EV-related load growth—depicted above by the flat, red line.

69. In my opinion, PREPA's Alternative Forecast presents a more reasonable (and the only plausible) forecast of electric vehicle demand in Puerto Rico through 2051. And, again,

even that forecast may well understate the likely amount of load increase resulting from EV adoption, given IHS Markit projections that 41% of cars in the U.S. will be electric by 2050.[69]

C. A More Realistic PREPA Net Load Projection Would Be Much Higher Than That Projected by PREPA

70. The FOMB's assumptions about gross load, energy efficiency, distributed generation, and electric vehicles together lead to a substantial downward bias in anticipated levels of electricity sales in the future. In **Figure 11** below, I show revised net load forecasts (not including the FOMB's elasticity effect which will be discussed separately in Section VII) using two sets of revised forecast components:

1) Forecasts for gross load are recalculated using revised macroeconomic model inputs for Puerto Rico's real GNP and population from Dr. Edwards (which I discussed earlier in Section VI.A).

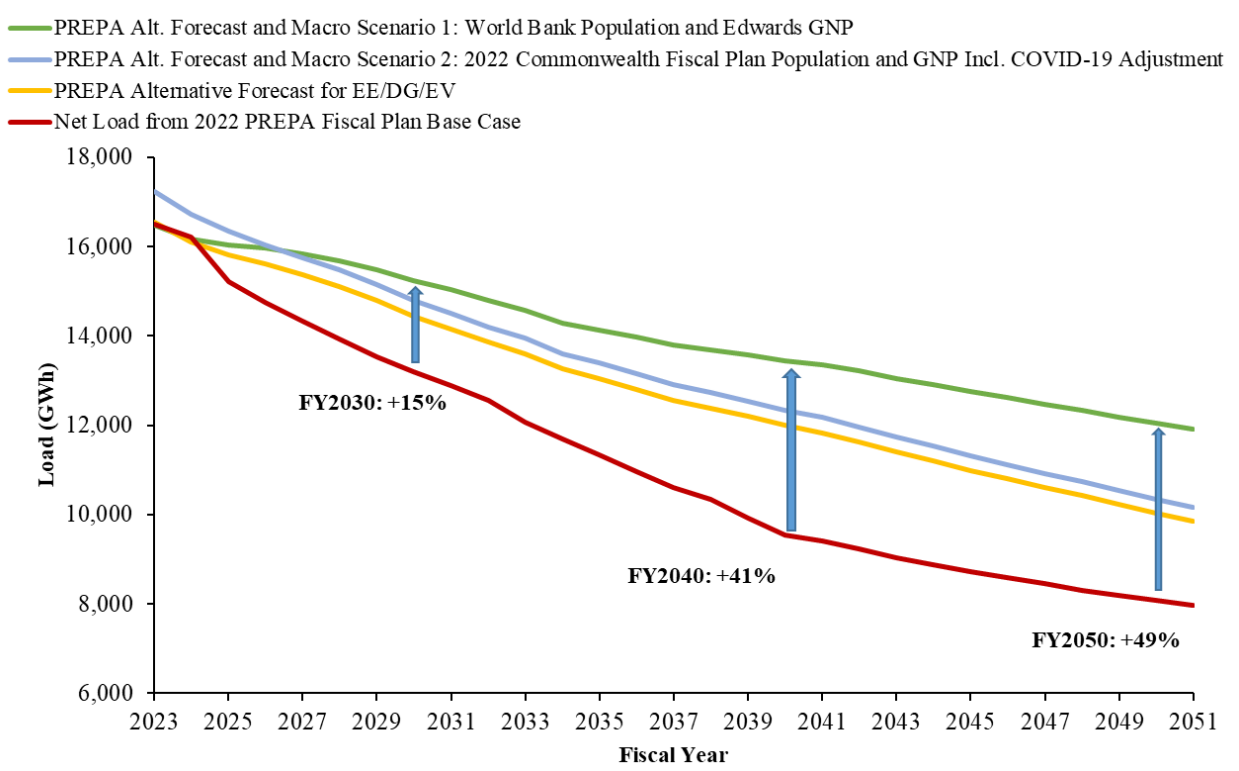
2) Forecasts for the energy efficiency, distributed generation, and electric vehicle load modifiers from the Base Case are replaced with PREPA's Alternative Forecast projections from the 2022 PREPA Fiscal Plan (which I discussed earlier in Section VI.B).

71. These revised net load forecasts show substantially higher loads compared to the Base Case net load forecast underlying the Legacy Charge Derivation. The revised net load forecast using PREPA's Alternative Forecast and Edwards's Solow growth model (the green line

[69] Plumer B, Popovich N, and Migliozzi B, "Electric Cars Are Coming. How Long until They Rule the Road?" New York Times, March 2021, available at https://www.nytimes.com/interactive/2021/03/10/climate/electric-vehicle-fleet-turnover.html.

in **Figure 11)** is 2,028 GWh (15%) higher than FOMB's net load forecast in 2030, and the revised net load forecast is 3,965 GWh (49%) higher in 2050.[70]

Figure 11: Revised PREPA Net Load Forecasts with PREPA Alternative Forecast Load Modifiers and Revised Macroeconomic Inputs, Fiscal Years 2023-2051



Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] Revenue Envelope and Legacy Charge Model.
[3] Edwards Report, Appendix C.

[70] *See* **Figure 11** Backup. I provide the revised net load forecasts for each customer type and fiscal year in **Appendix D**. For each revised net load forecast, I also recalculate the implied PREPA base rates for each customer type and fiscal year. I describe my base rate recalculation methodology and results in **Appendix E**.

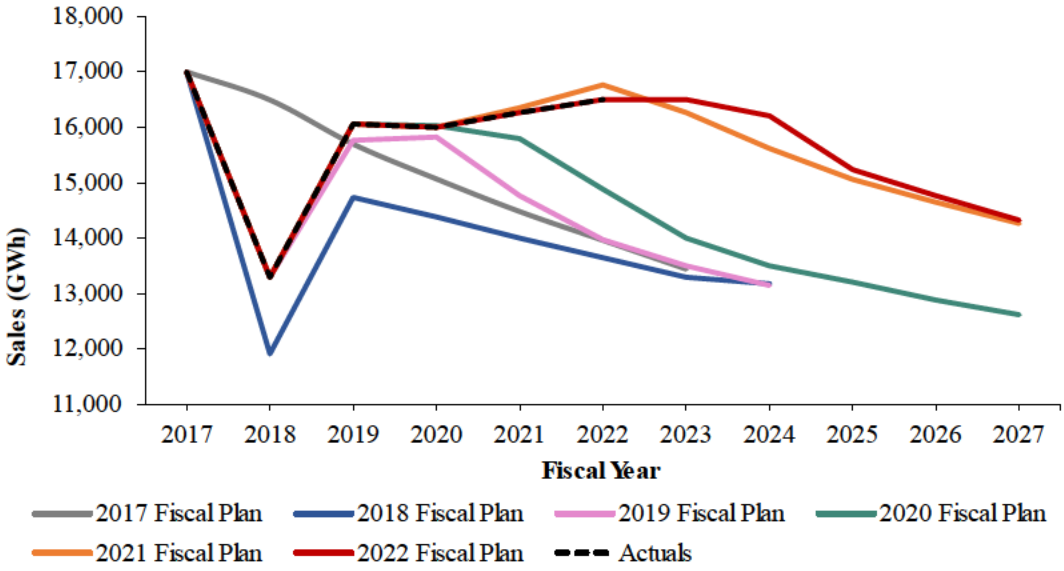
VI. PREPA HAS A TRACK RECORD OF UNDERESTIMATING NET LOAD

72. The clearest evidence that PREPA's net load forecasts incorporate a downward bias is their historical results. Each of PREPA's Fiscal Plans from 2017 through 2022 includes a projection of net load for the immediately upcoming fiscal years. In each of these years' forecast of future sales where there is now actual historical data to compare to PREPA's prior net load forecasts, the actual data exceed the prediction—sometimes substantially.

73. The dotted line in **Figure 12** (which tracks the historical portion of the red, 2022 Fiscal Plan line) shows PREPA's actual sales of electricity through fiscal year 2022. This is compared to other lines depicting the corresponding load forecast in PREPA's prior fiscal plans. For example, the 2017 PREPA Fiscal Plan projected that net load in fiscal year 2021 would be only 14,476 GWh, but the actual load that fiscal year was 16,280 GWh. That 11% underestimation of net load just four years earlier is a substantial forecasting error. The 2018-2020 PREPA Fiscal Plans included updated forecasts of net load in fiscal year 2021, each of which was also too low by amounts ranging from 3% to 14%[71].

[71] The 3% and 14% amounts are equal to the forecasted net sales for fiscal year 2021 from the 2020 PREPA Fiscal Plan and the 2018 PREPA Fiscal Plan, respectively, divided by actual observed net sales for fiscal year 2021.

Figure 12: Net Load Forecasts from 2017 – 2022 PREPA Fiscal Plans



Notes:
[1] Actual load values are as presented in the 2022 PREPA Fiscal Plan Model for fiscal years 2017-2022.
[2] Numerical values for load forecasts in the 2017 and 2018 PREPA Fiscal Plans were reported in the 2019 PREPA Fiscal Plan.
Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] 2021 PREPA Fiscal Plan Model.
[3] 2020 PREPA Fiscal Plan Model.
[4] PREPA, "2019 FOMB - Fiscal Plan for PREPA, as Certified by FOMB on June 27 2019," June 27, 2019, p. 57, available at https://aeepr.com/es-pr/Documents/Exhibit%201%20-%202019%20Fiscal_Plan_for_PREPA_Certified_FOMB%20on_June_27_2019.pdf.

74. In my opinion, the repeated pattern and directional consistency of PREPA's forecasting errors demonstrate a methodology that, as I discussed above, is inappropriately biased due to aggressive and unsupportable assumptions about the pace of consumers' adoption of technologies and measures that affect PREPA's net load.

VII. ELECTRICITY DEMAND IS NOT AS RESPONSIVE TO CHANGES IN ELECTRICITY PRICES AS FOMB ASSUMES

75. In a separate part of its Legacy Charge Derivation, FOMB takes PREPA's base case net load forecast and further modifies it downward by an "elasticity effect." That elasticity effect reflects FOMB's view that incremental increases in PREPA's rates from the Legacy Charge would cause some reduction in electricity demand. That price-related demand reduction,

according to FOMB, would result in lower-than-expected load as compared to the load forecast that otherwise results from the factors I have described above. FOMB argues that this demand reduction would then lead to less revenue collected to cover PREPA's fixed costs. FOMB states that it needs to reserve a portion of PREPA's available "Revenue Envelope"[72] to make up for that assumed shortfall, thus reducing its ability to repay creditors.[73]

76. For the reasons I discuss below, FOMB's estimation of that elasticity effect is unreasonable, inconsistent with the academic literature on elasticity, and unsupported by PREPA's own prior load-forecasting assumptions.

A. Background On Price Elasticity In Electricity

77. Price elasticity refers to the degree to which consumer demand changes in response to a change in price.[74] Mathematically, the elasticity of demand measures the percentage change in the quantity demanded for a product or service due to a one percent change in the price of that product or service.[75] A price elasticity of −0.6, for example, means that the quantity demanded decreases 0.6% in response to a 1.0% price increase.

78. In electricity markets, there are a number of ways in which higher rates might affect electricity demand: (i) customers might make behavioral changes (e.g., turning off lights,

[72] As described in Dr. Maureen Chakraborty's Expert Report, the "Revenue Envelope" is the maximum additional revenue that could be generated by the Legacy Charge that is affordable to PREPA customers. Chakraborty Report, Sections II and III.

[73] "An important consideration for the Oversight Board in designing the Legacy Charge was the impact that increasing PREPA's rates would have on PREPA's sales. As a general matter, the higher PREPA's rates are, the more PREPA's rates incentivize customers to choose alternatives." Legacy Charge Derivation, p. 3.

[74] Besanko, David and Ronald Braeutigam, *Microeconomics*, John Wiley & Sons, 6th Ed., 2020 (hereafter "Besanko and Braeutigam (2020)"), p. 44, available at https://faculty ksu.edu.sa/sites/default/files/David%20Besanko%2C%20Ronald%20Braeutigam%20-%20Microeconomics-Wiley%20%282020%29.pdf.

[75] Besanko and Braeutigam (2020), pp. 44-45.

waiting longer before turning on the air conditioning) resulting in lower power consumption; (ii) customers might invest in and install technologies (more efficient appliances, rooftop solar panels, etc.) that reduce electricity purchases from the grid; or (iii) customers might leave the grid entirely (going "off-grid" by taking full responsibility for their own electricity supply, moving away, etc.).

79. Elasticity effects in the use of electricity differ by customer type. For example, companies that engage in electricity-intensive activities may be more sensitive to electricity prices in their consumption decisions and be more motivated to find alternatives that reduce electricity purchases from the grid if the expense of that electricity grows and is expected to remain higher in the future.[76] By contrast, other customers might use electricity only for necessary basic functions (*e.g.*, lighting, refrigeration, etc.), or may run a business in which electricity costs are only a small fraction of total expenses, and thus be far less sensitive to electricity prices in their consumption decisions.

80. Elasticity effects in use of electricity also may differ by time horizon, because consumers' ability to adjust their electricity consumption in response to price changes varies over time. Generally speaking, consumers have fewer opportunities to adjust to electricity price changes in the near term than in the long term. For example, a residential customer facing higher electricity rates may be able to replace household appliances with more energy-efficient models

[76] "To see why a business might care about the price elasticity of demand, let's consider how an increase in price might affect a business's total revenue, that is, the selling price times the quantity of product it sells, or PQ. You might think that when the price rises, so will the total revenue, but a higher price will generally reduce the quantity demanded. Thus, the "benefit" of the higher price is offset by the "cost" due to the reduction in quantity, and businesses must generally consider this trade-off when they think about raising a price. If the demand is elastic (the quantity demanded is relatively sensitive to price), the quantity reduction will outweigh the benefit of the higher price, and total revenue will fall. If the demand is inelastic (the quantity demanded is relatively insensitive to price), the quantity reduction will not be too severe, and total revenue will go up. Thus, knowledge of the price elasticity of demand can help a business predict the revenue impact of a price increase." Besanko and Braeutigam (2020), p. 49.

over a few years but is less likely to do so immediately after seeing the first increase in her utility bill.

B. FOMB's Price Elasticity Assumptions Are Unsupported And Contradicted By The Academic Literature

1. FOMB's Posited Elasticity Effect Is Estimated From A Series Of Unexplained Assumptions And Adjustments

81. FOMB's Legacy Charge Derivation assumes the same short-run elasticity of 0.2 for each of PREPA's rate classes.[77] In the short run, therefore, FOMB assumes that a 1% price increase will cause a 0.2% decrease in sales for each class of customers. Over the long run, however, FOMB assumes different elasticity rates for different customer groups.

82. **Table 2**, in its first and third columns, shows FOMB's short- and long-term elasticity estimates for each customer class as used in the FOMB's Legacy Charge Derivation. The middle column of the table lists the "Long Run Elasticity Factors" the FOMB uses. For example, as the table shows, PREPA's general residential customers, in rate class GRS 112, are estimated to have a long-run elasticity of -1.7 (*i.e.*, a 1.7% decline in demand for every 1% increase in price). Commercial customers, in rate class GSS 211, are estimated to have less elastic demand (*i.e.*, demand that is less responsive to price changes), with a long-run elasticity of -0.68.

[77] PREPA's "rate classes" are its classifications of customer types that are typically charged different prices and may face different pricing structures. PREPA's rate classes and pricing per rate class are described in detail in PREPA's tariff book. PREPA, "Tariff Book - Electric Service Rates and Riders," May 28, 2019, available at https://aeepr.com/es-pr/QuienesSomos/Ley57/Facturaci%C3%B3n/Tariff%20Book%20-%20Electric%20Service%20Rates%20and%20Riders%20Revised%20by%20Order%2005172019%20Approved%20by%20Order%2005282019.pdf; Revenue Envelope and Legacy Charge Model.

Table 2: Elasticity Assumptions by PREPA Rate Class Used in Legacy Charge Derivation

	Short Run Elasticity	Long Run Elasticity Factors	Long Run Elasticity
Residential			
RH3, LRS, RFR	-0.2	100%	-1.7
GRS 111	-0.2	100%	-1.7
GRS 112 (LC Subsidy eligible)	-0.2	100%	-1.7
GRS 112 (General)	-0.2	---	-1.7
Commercial			
GSS 211	-0.2	40%	-0.68
GSP 212	-0.2	70%	-1.19
GST 213	-0.2	100%	-1.7
Government			
GSS 211	-0.2	40%	-0.68
GSP 212	-0.2	70%	-1.19
GST 213	-0.2	100%	-1.7
Municipalities			
GSS 211	-0.2	40%	-0.68
GSP 212	-0.2	70%	-1.19
GST 213	-0.2	100%	-1.7
Industrial			
GSS 311	-0.2	50%	-0.85
GSP 312	-0.2	50%	-0.85
GST 313	-0.2	75%	-1.275
TOU-T 363	-0.2	75%	-1.275
LIS 333	-0.2	75%	-1.275
TOU-T 963	-0.2	75%	-1.275

Source:
[1] Revenue Envelope and Legacy Charge Model.

83. The FOMB derives these estimates of each customer class's long-run elasticity from two academic papers: Burke and Abayasekara (2018),[78] published in *The Energy Journal*, and Buchsbaum (2022),[79] an unpublished, non-peer reviewed working paper. Burke and

[78] Burke, Paul J. and Ashani Abayasekara, "The Price Elasticity of Electricity Demand in the United States: A Three-Dimensional Analysis," The Energy Journal, Vol. 39, 2018 (hereafter "Burke and Abayasekara (2018)"), FOMB_PREPA 00020208 - FOMB_PREPA 00020243, available at https://doi.org/10.5547/01956574.39.2.pbur.

[79] Buchsbaum, Jesse, "Long-Run Price Elasticities and Mechanisms: Empirical Evidence from Residential Electricity Consumers," *Energy Institute Working Paper 331*, 2022 (hereafter "Buchsbaum (2022)"), FOMB_PREPA 00022518 - FOMB_PREPA 00022589, available at https://haas.berkeley.edu/wp-content/uploads/WP331.pdf.

Abayasekara (2018) use U.S. state-level data for the lower 48 states, from 2003-2015, to estimate long-term elasticities for different customer classes: residential (-1.0), commercial (-0.3 to -0.6), industrial (-1.2), and general (-0.9).[80] Buchsbaum (2022) uses data on residential PG&E customers in Northern and Central California, from 2008-2020, to estimate those customers' long-run price elasticity at -2.4.[81]

84. The FOMB uses the Burke and Abayasekara (2018) values to set baseline estimates of each customer class's long-run elasticity.[82] The FOMB asserts, however, that those baseline estimates *do not* reflect any effect on customers' price elasticity of their potential adoption of solar PV systems in response to higher electricity rates.[83] By contrast, the FOMB asserts that the Buchsbaum (2022) estimate of PG&E residential customers' long-run elasticity *does* account for the potential adoption of solar PV systems.[84] FOMB thus takes the difference between the two estimates of residential elasticity (-1.4) and calls it an "Incremental Solar PV effect."[85] FOMB then adds half of that amount (or -0.7) to the Burke and Abayasekara (2018) baseline estimate of residential customers' long-run elasticity (-1.0), resulting in FOMB's final estimate of their long-run elasticity of -1.7.[86] By this measurement, approximately 40% of residential customers' long-run elasticity would be attributable solely to the option to install solar panels.

[80] Burke and Abayasekara (2018).

[81] Buchsbaum (2022), pp. 3, 10.

[82] "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

[83] "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

[84] "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

[85] -1.4 is the difference between the Buchsbaum (2022) estimate of residential elasticity of -2.4 minus the Burke and Abayasekara (2018) estimate of -1.0. "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

[86] "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

85. Further complicating this unusual elasticity calculation, the FOMB then estimates long-run elasticity for other customer classes by applying different percentages of the "Incremental Solar PV Effect" to the Burke and Abayasekara (2018) estimates of elasticity for the commercial and industrial customer classes.[87] The FOMB then calculates rounded "Long Run Elasticity Factors" by customer classes as a specified percentage of general residential customers' long-term elasticity.[88] Those "Long Run Elasticity Factors," and each customer class's final, long-run elasticity estimate are listed in **Table 2**.

86. The FOMB does not provide any supporting documents related to its assumption of the same short-term elasticity of -0.2 across all customer classes. The two papers FOMB uses for its long-term elasticity estimates calculate different short-term elasticity estimates. Burke and Abayasekara (2018) calculate short-term elasticity of "around -0.1 or less for all sectors"[89] and Buchsbaum estimates short-term elasticity of -0.36.[90]

2. The Board's Long-Term Elasticity Estimates Are Not Supported By The Cited Authority

87. The FOMB's analysis is not supported by the academic papers it relies on, and its methodological approach results in flawed and unreliable long-run elasticity estimates.

88. First, the FOMB misinterprets the Burke and Abayasekara (2018) results when it contends that their estimates *exclude* solar PV effects (if any). In fact, Burke and Abayasekara (2018) estimates the demand reduction from higher electricity prices attributable to *all* causes,

[87] The percentage of the "Incremental Solar PV Effect" applied ranges from 5% to 100% depending on the commercial or industrial rate class. "LT Elasticity workbook.xlsx," FOMB_PREPA 00022590.

[88] Revenue Envelope and Legacy Charge Model.

[89] Burke and Abayasekara (2018), p. 123.

[90] Buchsbaum (2022), p. 1.

necessarily including any such reduction relating to solar PV adoption. The data underlying Burke and Abayasekara (2018) extend through 2015, and so cover a period during which solar installations increased and were available to many customers. There is thus no basis for the FOMB's adjustment of the Burke and Abayasekara (2018) elasticity estimates upward to incorporate any additional elasticity effect corresponding to solar PV system adoption.

89. Moreover, the FOMB is mistaken that the Buchsbaum (2022) estimate of higher long-run elasticity for PG&E residential customers is premised on those customers' ability to adopt solar PV systems. First, Buchsbaum himself states that, "[n]otably, I do not find that consumers are responsive to long-run prices in their adoption of rooftop solar or utility energy efficiency programs,"[91] and that his results "effectively rule out solar and energy efficiency programs as mechanisms driving the observed long-run elasticities."[92] Put another way, while FOMB relies on this working paper to assert that there is a substantial, incremental elasticity effect caused solely by the availability of rooftop solar panels, the author of the paper himself expressly concludes otherwise. Buchsbaum (2022), like Burke and Abayasekara (2018), observes that his data already takes into account any elasticity effect of solar PV adoption, and Buchsbaum expressly concludes that solar PV adoption has no "incremental effect" on elasticity.

90. Second, Buchsbaum explains that his working paper's results were generated in part by using atypical data and methodology—it "leverage[s] a novel source of cross-sectional price variation."[93] Neither the findings in Buchsbaum (2022) nor the methodology used to

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[91] Buchsbaum (2022), p. 4.

[92] Buchsbaum (2022), p. 36.

[93] Buchsbaum (2022), p. 43.

generate them, have been peer-reviewed—or even published. Thus, even properly characterized, Buchsbaum (2002)'s results have not been demonstrated to be reliable.

91. Third and finally, Buchsbaum (2022) explains that the elasticities calculated for PG&E residential customers "are specific to the geography and climate in this northern and central California sample."[94] To state what should be obvious, the geography and climate of northern and central California are dissimilar to that of Puerto Rico.

92. For these reasons, the FOMB erred in relying on the Buchsbaum (2022) working paper in its analysis of any elasticity effect of increasing the rates paid by PREPA customers, and by assuming any "Incremental Solar PV Effect" based on a working paper that expressly rejects any such "incremental effect."

3. The Board's Long-Term Elasticity Estimates Are Substantially Higher Than The Academic Consensus Reflected By Surveys Of Hundreds Of Studies

93. By selecting the Burke and Abayasekara (2018) findings as "baseline estimates" of long-term price elasticity, and then adding to those baseline estimates an "Incremental Solar PV Effect" derived from the Buchsbaum (2022) working paper, the FOMB generates estimates of long-term elasticities that are significantly higher than the consensus in the academic literature. The effect of doing so is to overstate the amount of demand reduction that new rate increases would cause, and thereby to understate the amount of PREPA's available Revenue Envelope that could be devoted to debt service.

94. Zhu et. al. (2018) surveyed 196 other studies of the price elasticity of electricity demand for the residential sector globally. This paper found that the mean estimate of long-term

[94] Buchsbaum (2022), pp. 4-5.

residential elasticity was -0.577, which is roughly one-third as large as the Board's estimate.[95] Likewise, Labandeira et. al. (2017) surveyed 232 estimates of the price elasticity of electricity demand from around the world and found a mean estimate of long-term elasticity of -0.481 for the residential sector—just over one-quarter of the FOMB's estimate.[96]

95. The FOMB's long-term elasticity estimates are out of line with these and other results demonstrating the consensus of the academic literature, and consequently produce an inflated, upward-biased elasticity effect.[97] The Buchsbaum (2022) estimate of elasticity for PG&E residential customers in northern and central California, in particular, is well above common elasticity estimates found in the literature. The FOMB's elasticity estimates are similarly greatly overstated as a result of FOMB's method that makes incremental additions to the estimates provided by Burke and Abayasekara (2018).

C. FOMB's Own Gross Load Forecast Assumes Zero Elasticity

96. As part of my analysis, I reviewed PREPA's 2022 Fiscal Plan, and the underlying regression models developed in connection with PREPA's 2019 IRP, to see what level of price elasticity of electricity demand PREPA has been assuming as part of its own forecasting of gross load. The answer is zero: the gross load forecast presented in PREPA's 2022 Fiscal Plan is based on regression models that assume no short-term elasticity for any of the forecasted customer

[95] Zhu, Xing, Lanlan Li, Kaile Zhou, Xiaoling Zhang, and Shanlin Yang, "A Meta-Analysis on the Price Elasticity and Income Elasticity of Residential Electricity Demand," Journal of Cleaner Production, Vol. 201, November 10, 2018, pp. 169-177, available at https://www.sciencedirect.com/science/article/abs/pii/S0959652618323588.

[96] Labandeira, Xavier, José M. Labeaga, and Xiral López-Otero, "A Meta-Analysis on the Price Elasticity of Energy Demand," Energy Policy, Vol. 102, March 2017, pp. 549-568, available at https://www.sciencedirect.com/science/article/abs/pii/S0301421517300022. Labandeira et. al. also found mean estimated elasticities of -0.664 for the commercial sector, and -0.510 for the industrial sector.

[97] Both the Zhu et al. (2018) and Labandeira et al. (2017) studies also find different estimates of short-term elasticity compared to the -0.2 that the FOMB assumes. I provide a summary of the long- and short-term elasticities discussed in this section as **Appendix F**.

types. Even the two load modifiers applied to reduce PREPA's net load forecast—energy efficiency and distributed generation—are applied without building in a sensitivity to changes in price.

97. PREPA's own 2019 IRP states that "customer rates were considered" as a potential explanatory (independent) variable in the analysis, "but they were found not to have a strong historic correlation to demand and explanatory power."[98] In other words, PREPA itself concluded that price changes are not a significant factor that meaningfully explains the amount of electricity that PREPA's customers will need and demand.

98. The 2019 IRP further explains that residential and commercial electricity demand in Puerto Rico is essentially *inelastic*—that is, that is has an elasticity near 0.0. "The residential sector," PREPA's 2019 IRP explains, "is traditionally a sector with low response to changes in retail rates and to some exten[t] the commercial customers."[99] The 2019 IRP also stated that Puerto Rico's industry mix is likewise not particularly sensitive to changes in electricity prices: "The manufacturing sector in Puerto Rico, mostly comprised of pharmaceutical, textiles, petrochemicals, and electronics, appears to be less responsive to changes in customer rates compared to other manufacturing industries such as steel or aluminum, which are highly sensitive (high elasticity)."[100] It is not surprising that firms that are sensitive to electricity prices do not locate on an island that has relatively high electricity prices. The 2019 IRP's gross load

[98] 2019 IRP, Section 3.1.3.

[99] 2019 IRP, Section 3.1.3.

[100] 2019 IRP, Section 3.1.3.

regressions – which are the bases for the gross load forecasts underlying the forecasts used in the Plan of Adjustment – do not include any short-term elasticity adjustments.[101]

99. In sum, the preceding discussion shows that the FOMB's methodology for arriving at its elasticity effect estimates is convoluted, involves unexplained assumptions, and relies inappropriately on two papers (one unpublished) to produce elasticity effects that are outside—and well above—the consensus of the academic literature. The resulting figures significantly overstate the potential effect of future rate increases on the level of PREPA's sales to its customers.

VIII. THE FOMB ARTIFICIALLY INFLATES PREPA'S LIKELY FUTURE CAPITAL EXPENDITURES TO DERIVE ITS LEGACY CHARGE

100. PREPA's assumptions about its future capital costs are a key input into its revenue requirement—i.e., the amount of revenues the utility states that it will need to collect from customers to cover its costs—and rate forecasts. In standard utility ratemaking, all else being equal, unreasonably high statements of capital costs would increase a utility's overall revenue requirements and thus the level of rates that it believes it will need to charge to customers. In the context of this proceeding, unreasonably high projections of future capital costs would put downward pressure on the amount of potential available revenues available to be collected from customers by a Legacy Charge to fund creditor recoveries.

[101] Furthermore, the PREPA's methodology of applying energy-efficiency and distributed-generation load modifiers to achieve a base case net load forecast that is substantially lower than its gross load forecast already assumes that some customers will adopt energy efficiency and rooftop solar generation in part to reduce their electricity purchases from the grid. In so doing, that net load forecast already implicitly assumes a form of long-term demand elasticity among PREPA's customers. By nevertheless adding, as part of its Legacy Charge Derivation model, an *additional* elasticity effect over and above these net load forecast assumptions the FOMB is effectively double-counting overall elasticity effects.

101. The FOMB overstates future capital expenditures in two separate respects, each of which affects the amount of the Legacy Charge that FOMB derives. First, the capital expenditures assumed in the 2022 PREPA Fiscal Plan are overly inflated due to outdated data and would be $1.94 billion (undiscounted value) lower over FY 2023-2051 if updated.[102] Second, and independently, I find no reliable support for the FOMB's assumption, in its Legacy Charge Derivation, that PREPA will face unspecified capital expenditures totaling $2.425 billion (undiscounted value) over and above what is already assumed by its 2022 PREPA Fiscal Plan—which was certified by the Board.[103] The FOMB's contention that these additional billions of dollars of capital expenditures, which were not anticipated by it or PREPA less than a year ago, are now critically necessary in order for PREPA to "remain a viable operating entity" is surprising, unexplained, and wholly inconsistent with standard utility practice.[104]

102. Therefore, I find that the total capital expenditures that are inputs to FOMB's Legacy Charge Derivation are inflated by $4.37 billion over FY 2023-2051.[105]

A. PREPA's Legacy Charge Derivation Uses A Capital Cost Forecast That Is Outdated And Too High Compared To LUMA's Latest Forecasts

103. The 2022 PREPA Fiscal Plan's projections of PREPA-funded capital expenditures—i.e., capital investments that are intended to be put into rates charged to customers and recovered from them—are based on April 2022 forecasts by LUMA for the three fiscal years

[102] *See* **Figure 13** Backup.

[103] *See* **Figure 13** Backup.

[104] Legacy Charge Derivation, p. 7.

[105] $4.37 billion is the sum of $1.94 billion assumed in the 2022 PREPA Fiscal Plan and $2.425 billion assumed by the FOMB in the Legacy Charge Derivation.

of 2023, 2024, and 2025.[106] For each subsequent year through 2051, the 2022 PREPA Fiscal Plan assumes that the costs associated with the PREPA-funded capital expenditures will be the same as the forecast in fiscal year 2025, grown at the rate of inflation.[107]

104. However, LUMA has subsequently updated its forecast for PREPA-funded capital expenditures and provides new forecasts for each fiscal year between 2023 and 2032. The updated LUMA forecasts of such PREPA-funded capital expenditures beyond fiscal year 2025 are markedly lower than PREPA's assumptions in the 2022 PREPA Fiscal Plan and are consistent with LUMA's multi-phase proposed recovery and transformation roadmap.[108] The PREPA Fiscal Plan notes that LUMA plans an initial surge of capital expenditures to restore "high-risk infrastructure and processes to a safe and functioning state," but this phase is not expected to continue indefinitely.[109] LUMA's revised outlook undermines PREPA's Fiscal Plan assumptions about customer-funded capital costs for the years beyond 2025.

105. **Figure 13** compares the PREPA-funded capital expenditure forecasts as shown in the 2022 PREPA Fiscal Plan with the updated LUMA forecasts. For the period between FY 2023 and 2032, the 2022 PREPA Fiscal Plan assumes $359 million more in PREPA-funded capital expenditures than in the updated LUMA projection.[110] If one were to assume that the amount of PREPA-funded capital expenditures in fiscal year 2032 were maintained until fiscal year 2051 and grown at the rate of inflation (which is the same growth approach used in the 2022 PREPA

[106] 2022 PREPA Fiscal Plan, Exhibit 35; 2022 PREPA Fiscal Plan Model.

[107] 2022 PREPA Fiscal Plan Model.

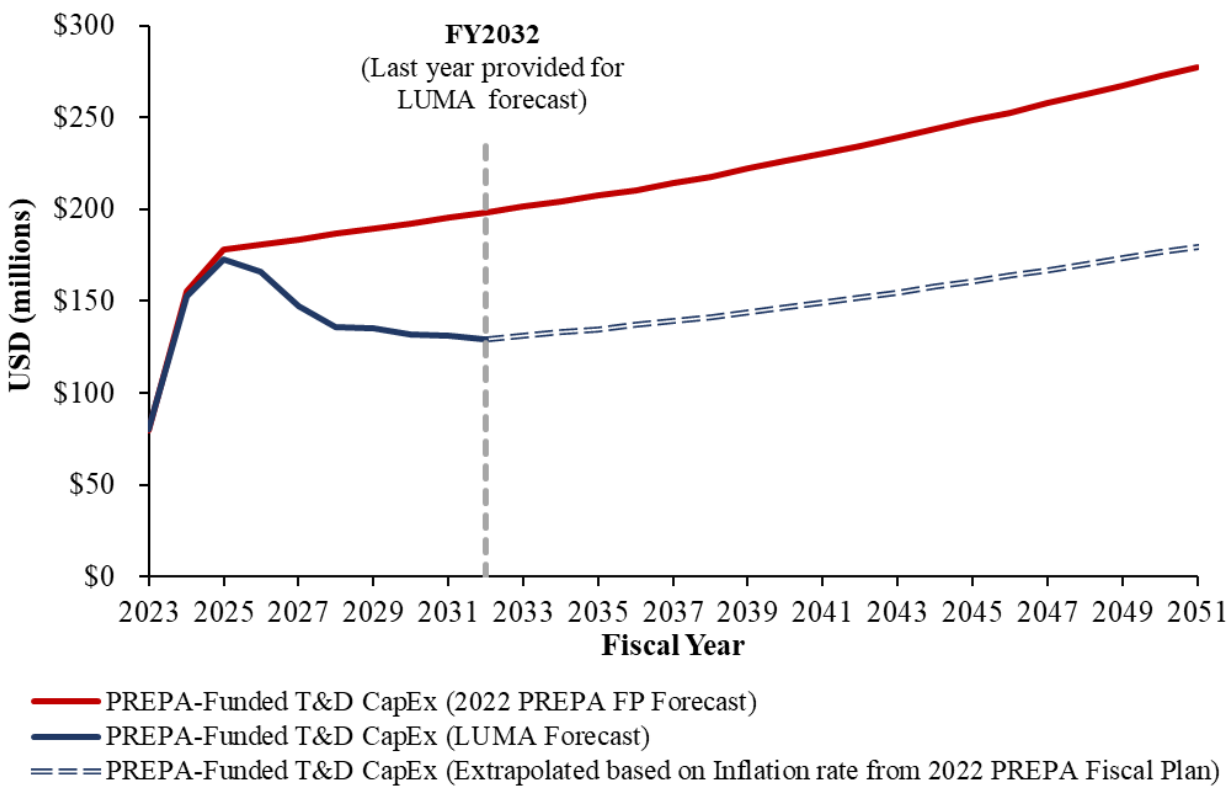
[108] 2022 PREPA Fiscal Plan, p. 99 and Exhibit 36; "Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx," FOMB_PREPA 00020150.

[109] 2022 PREPA Fiscal Plan, p. 99 and Exhibit 36.

[110] *See* **Figure 13** Backup.

Fiscal Plan after FY2025), then the 2022 PREPA Fiscal Plan would overstate PREPA-funded capital expenditures by a total of $1.94 billion (undiscounted value) relative to the amount indicated in the updated LUMA projection.

Figure 13: Differences in PREPA-Funded Capital Expenditure Forecasts Between 2022 PREPA Fiscal Plan and Updated LUMA Projections



Sources:
[1] "Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx", FOMB_PREPA 00020150.
[2] 2022 PREPA Fiscal Plan Model.

106. This overstated forecast of capital expenditures from the 2022 PREPA Fiscal Plan is an input to its Legacy Charge Derivation, which relies on the capital expenditure forecasts in the 2022 Fiscal Plan even though they have been reduced by LUMA in its more recent projections. All else being equal, the FOMB's reliance on outdated data would lead to an understated value for the Legacy Charge that can be supported in customer rates.

B. PREPA's Legacy Charge Derivation Assumes Additional Capital Costs That Are Unreasonable and Inconsistent With PREPA's Own Fiscal Plan

107. PREPA included (and, as discussed above, overstates) sizable capital expenditures in its 2022 Fiscal Plan, certified by the FOMB to be adequate to meet PREPA's needs. The FOMB nevertheless asserts, as part of its Legacy Charge Derivation, that the projection of future capital expenditures in PREPA's 2022 Fiscal Plan does not include "capital expenditures (and matches to federal funding) PREPA will likely need to make to remain a viable operating entity."[111] The Legacy Charge Derivation thus assumes, with little support or explanation, that PREPA will require an estimated $2.425 billion in *additional* revenues (undiscounted) to fund capital expenditures through 2051 beyond the capital costs already accounted for in the certified 2022 PREPA Fiscal Plan.[112] As a result, according to the FOMB, a portion of PREPA's Revenue Envelope of potential new revenues must be reserved for capital expenditure and so is not available for creditor recoveries.[113]

108. **Figure 14** shows these additional annual capital expenditures assumed in the Legacy Charge Derivation. The FOMB assumes (a) an additional $50 million a year for each fiscal year between 2024 and 2033, and (b) an increasing annual expenditure thereafter, starting at $91.7 million in 2034 and rising to $124.5 million in 2051[114].

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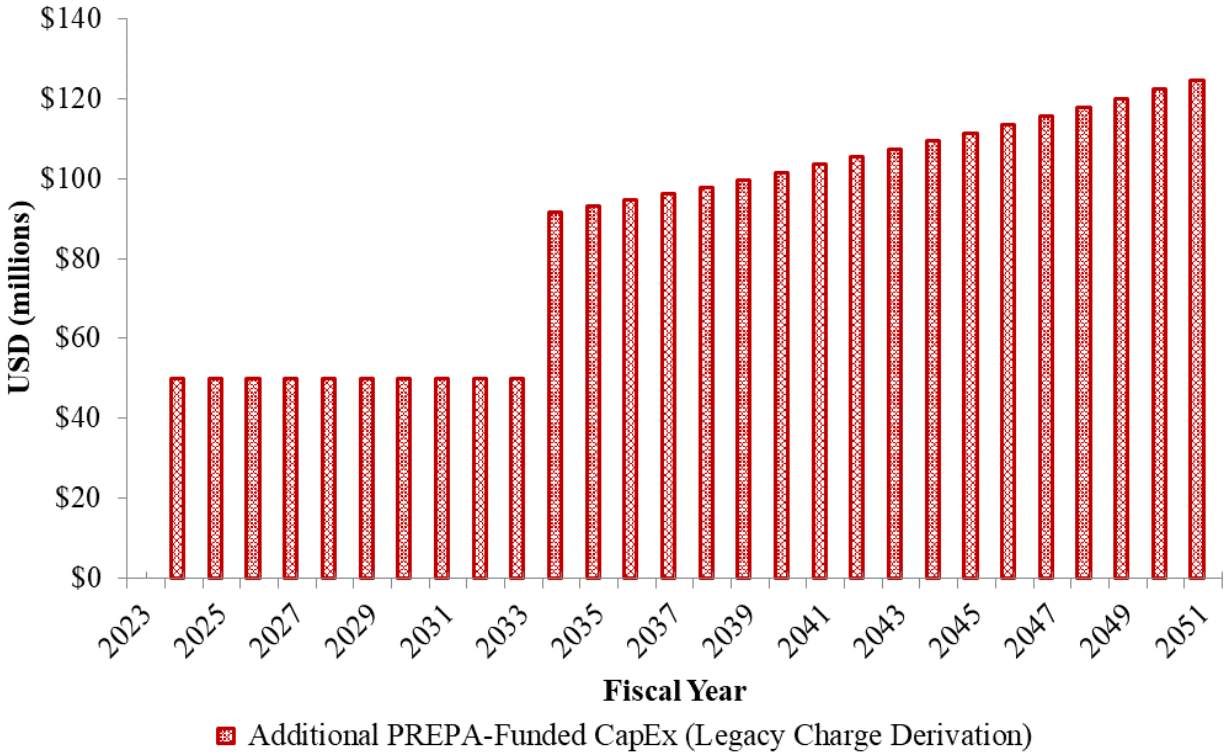
[111] Legacy Charge Derivation, p.7.

[112] Legacy Charge Derivation, p.7.

[113] Legacy Charge Derivation, p.7.

[114] *See* **Figure 14** Backup.

Figure 14: Incremental Capital Expenditures Assumed in the Legacy Charge Derivation That are Beyond 2022 PREPA Fiscal Plan's Capital Investment Forecast



Source:
[1] "20221115 Risk model.xlsx", FOMB_PREPA 00022385.

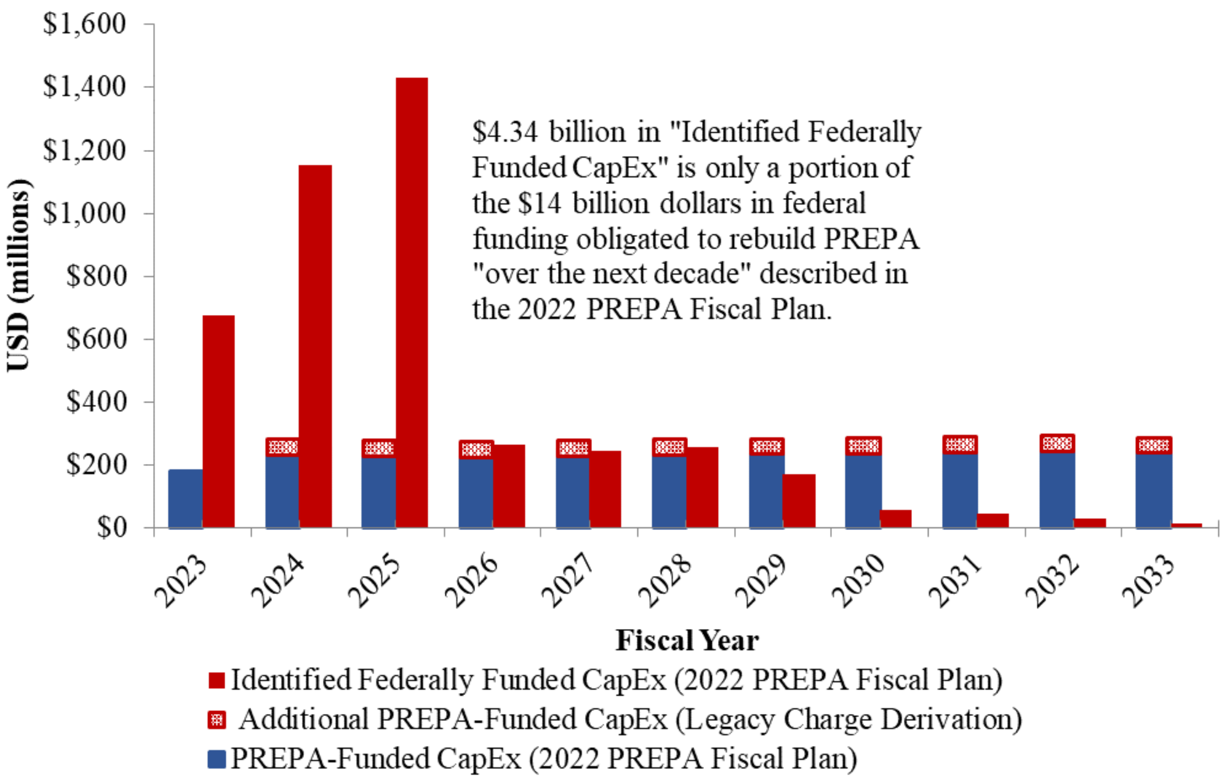
109. These additional, incremental capital expenditures are unreasonable and unreliable for at least three reasons: First, FOMB has not explained why these additional capital expenditures, if they are truly necessary to keep PREPA a "viable operating entity," were not contemplated or provided for under the 2022 Fiscal Plan certified in June 2022. In that Fiscal Plan, PREPA and the FOMB forecast future expenses at a level sufficient for PREB to "determine rates […] such that they provide PREPA with the revenue – or funds – that it requires to pay for all of the projected expenses needed to provide adequate service to its customers and pay its obligations."[115] The FOMB does not explain why PREPA neglected to include $2.425

[115] 2022 PREPA Fiscal Plan, p. 159.

billion in mission-critical capital expenditures—or why they have become evident only as part of its analysis of how much of PREPA's potential future revenues can be used to fund creditor recoveries under the Plan.

110. Second, the FOMB's Legacy Charge Derivation unreasonably assumes $50 million in additional annual capital costs from fiscal years 2024 through 2033 (or $500 million total, in nominal terms).[116] **Figure 15** shows this additional capital expenditure:

Figure 15: "CapEx Impact FEMA" Expenditures Assumed in Legacy Charge Derivation, FY2023-2033



Note:
[1] The 2022 PREPA Fiscal Plan Model includes an error in its calculation of "Identified Federally Funded Capital Expenditures" by double counting expenditures allocated to "Hydro, Dams & Irrigation". This figure corrects for the calculation error.
Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] Revenue Envelope and Legacy Charge Model.

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116 *See* **Figure 14, 15, and 16** Backup.

111. The FOMB describes this annual $50 million as reflecting “Capex Impact FEMA.”[117] But PREPA’s 2022 PREPA Fiscal Plan already includes projections of PREPA’s cost-share obligations on FEMA and other federally funded capital expenditures, and excluded them from PREPA’s revenue requirement estimate because they were assumed to be funded by the federal government rather than by customers.[118] In particular, PREPA assumed that the Department of Housing and Urban Development (“HUD”) would fund PREPA’s FEMA cost-share obligations.[119] However, FOMB assumes now—without evidence—that there is an annual net outlay by PREPA of $50 million related to “Capex Impact FEMA” that means that PREPA cannot otherwise devote such revenues to pay creditors.[120] This assumption is at odds with current government statements; on April 27, 2023, Puerto Rico’s Secretary of State and AAFAF Executive Director Omar Marrero stated that “Right now, the way we see it is our capital investment needs are covered for the next 10 years. And this is across all infrastructure sectors including energy, water, education, public buildings and municipalities.”[121]

112. Third, the FOMB’s Legacy Charge Derivation unreasonably assumes—contrary to PREPA’s 2022 Fiscal Plan—that PREPA’s transmission and distribution system will require

[117] Revenue Envelope and Legacy Charge Model.

[118] During fiscal years 2023-2033, the 2022 PREPA Fiscal Plan includes specific estimates of “Identified Federally Funded Capital Expenditures” which total $4.34 billion, and include assumed spending on PREPA’s generation, transmission, distribution, hydroelectric dams, and irrigation. The $4.34 billion of “Identified” capital expenditures are only a small fraction of the $14 billion in total obligated expenditures described in the 2022 PREPA Fiscal Plan, as there are also obligated Federal Emergency Management Agency (“FEMA”) funds which have not been assigned to specific identified projects.

[119] 2022 PREPA Fiscal Plan, p. 86.

[120] In a letter between FOMB and LUMA counsel, LUMA asserts that “if [HUD cost-share funds] are not available, PREPA must identify other funds or adjust rates to cover the local cost-share required to access FEMA funds” and that PREPA’s projections do not include “missing cost-share funding [which] amounts to approximately $0.5 billion.” Letter from Covington and DLA Piper to Proskauer, FOMB_PREPA 00023701.

[121] Reorg, “With Federal Funds Expected to Cover CapEx Needs for Next Decade, Commonwealth Takes Measured Path Toward Investment-Grade Credit Ratings,” April 27, 2023.

annual capital spending of $250 million per year (in 2022 dollars) between fiscal years 2034 and 2051. The FOMB's Legacy Charge Derivation adjusts that sum for inflation, and labels it PREPA's "expected" capital spending target.[122] That target is $296 million in FY2034, $328M in FY2040, and so on.[123]

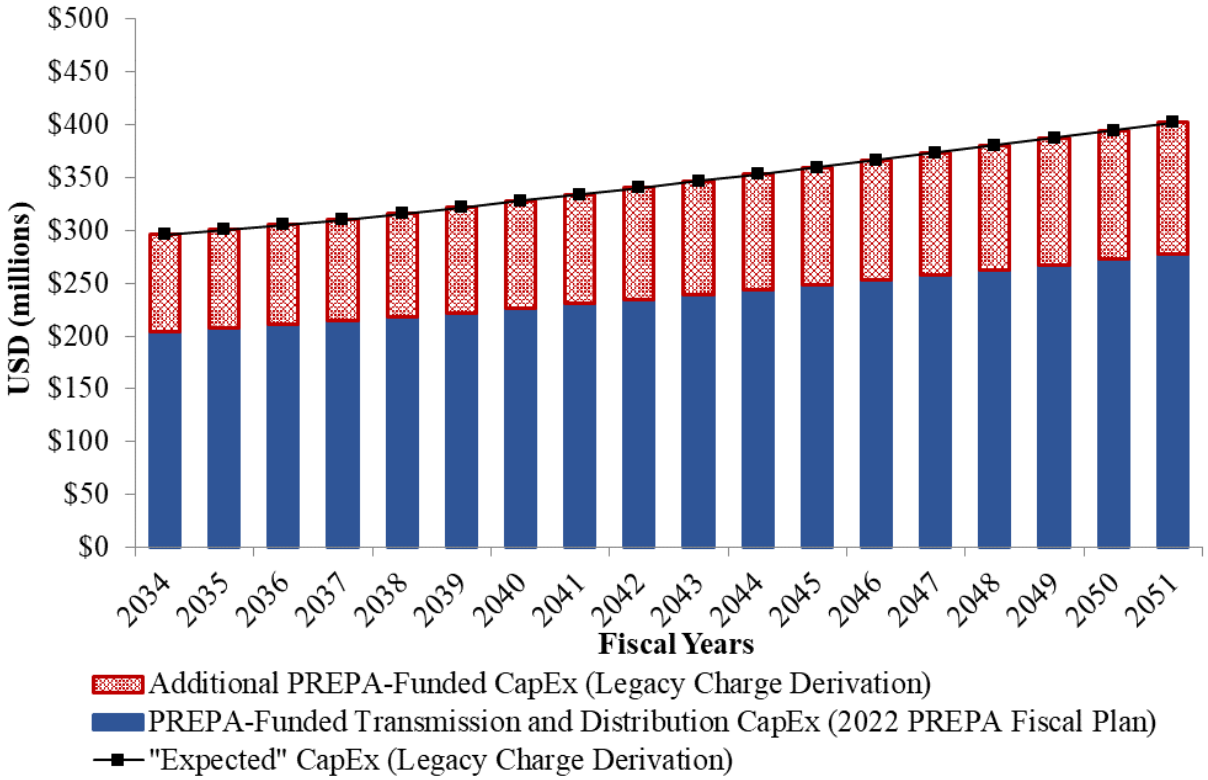
113. The FOMB then subtracts from those newly assumed capital-spending targets the amounts of such capital spending that are *actually* contemplated by the certified 2022 Fiscal Plan, with the result being sums of additional capital spending, in FY2034-FY2051, that are not contemplated in the 2022 Fiscal Plan but that, according to the FOMB, require the reserve of any new revenues ahead of creditor recoveries. It labels these additional capital expenses as the "Capex Impact Non-FEMA" in its Legacy Charge model. **Figure 16** shows that additional capital expense assumed by the FOMB's Legacy Charge Derivation, which increases annually from $91.7 in FY2034 to $124.5 million in FY2051—roughly a 45% annual increase over the capital spending forecast for the same years under the 2022 Fiscal Plan.[124]

[122] Revenue Envelope and Legacy Charge Model.

[123] Revenue Envelope and Legacy Charge Model.

[124] *See* **Figure 16** Backup.

Figure 16: "Capex Impact Non-FEMA" Assumed in Legacy Charge Derivation, FY 2034-2051



Sources:
[1] 2022 PREPA Fiscal Plan Model.
[2] Revenue Envelope and Legacy Charge Model.

114. FOMB has not explained why $250 million (in 2022 dollars) is a reasonable expected amount of additional capital expenditures on PREPA's transmission and distribution program from FY2034 through FY2051, or why that target is more reasonable than the lower capital expenditure estimates for those years in PREPA's approved 2022 Fiscal Plan. FOMB's assumption of additional capital expenditures in fiscal years 2034-2051 is unfounded.

115. In conclusion, there is no sound basis on which the FOMB's Legacy Charge Derivation reserves future additional revenue capacity for $2.425 billion in previously unanticipated, incremental capital expenditures. The basis for that sum is completely unexplained and disconnected from any identifiable project or need. It appears merely to state a

large "cushion" for possible future needs for which, until the FOMB developed its Legacy Charge Derivation, PREPA had not been forecasting or reserving. If unexpected capital needs not identified in the normal course of long-term planning are eventually identified, standard practice would be to obtain financing for such projects at that time, for example through a new bond offering.

IX. PREPA'S ASSUMPTIONS ABOUT THE COMMONWEALTH'S AND OTHER GOVERNMENTAL ENTITIES' NON-PAYMENT OF PAST ELECTRICITY BILLS IS INCONSISTENT WITH SOUND UTILITY PRACTICE

A. The Commonwealth And Other Governmental Entities Owe Large Amounts To PREPA

116. PREPA invoices Commonwealth government and municipal customers for electricity provided to them, and those accounts have historically been unpaid or underpaid. These past-due governmental accounts are responsible for large amounts of PREPA's customer accounts receivable.

117. As of March 31, 2022, based on the latest data provided by PREPA, Commonwealth government and municipal entities owed $2.23 billion in accrued accounts receivable to PREPA. This quantity includes unpaid bills accumulated by these entities that averaged $20.6 million per month during the period of April 2021 through March 2022 alone. Excluding accounts associated with PREPA's CILT (Contributions in Lieu of Taxes) arrangements, territorial government and municipal entities owed PREPA $719 million as of March 2022. This amount grew by an average of $13.5 million in additional unpaid bills per month between April 2021 and March 2022, dollar amounts that need to be recovered in rates

charged to other customers.[125] The Commonwealth and public corporations alone owed $265 million to PREPA as of March 2022.[126] **Table 3** summarizes PREPA accounts receivable from governmental and municipal entities.

Table 3: Summary Statistics for PREPA Accounts Receivable from Commonwealth Government and Municipal Entities, April 2021 – March 2022

	Number of Accounts	Aggregate Ending Balance as of March 2022	Aggregate Monthly Bills	Aggregate Monthly Unpaid Bills[1]
All Accounts	457	$ 2,231,589,373	$ 55,011,138	$ 20,648,185
Excluding CILT	377	$ 718,925,799	$ 47,820,204	$ 13,503,014
Excluding CILT and Public Lighting	299	$ 327,200,096	$ 38,590,359	$ 4,279,369
Excluding All Municipal Accounts	223	$ 284,096,603	$ 37,288,457	$ 4,131,315
Only Commonwealth and Public Corporations	141	$ 265,513,150	$ 33,296,191	$ 3,439,959

Note:
[1] Monthly unpaid bills are calculated as the monthly billed amount less the amount paid by the entity to PREPA each month.
Source:
[1] "Government Accounts Receivable March 2022.xlsx", FOMB_PREPA 00001467.

118. I understand that, under reforms made after the 2016 enactment of PROMESA, a variety of Puerto Rico governmental institutions now fall under the FOMB's oversight, including the Puerto Rico Aqueduct and Sewer Authority ("PRASA"), the University of Puerto Rico ("UPR"), and the various Commonwealth agencies and instrumentalities. The FOMB has direct oversight over the finances of these entities, yet many of them also owe large unpaid balances to PREPA. Some of these entities (like PRASA) completed debt-restructuring processes under PROMESA yet continue to owe large amounts of money to PREPA.[127]

119. In total, entities under the FOMB's oversight accounted for $140 million in PREPA accounts receivable as of March 31, 2022. That includes $5.7 million in unpaid bills to

[125] *See* **Table 3**.

[126] *See* **Table 3**.

[127] For example, PRASA signed a loan modification agreement in 2019 under PROMESA's Section 207 to lower its debt service payments under U.S. government loans. Financial Oversight & Management Board of Puerto Rico, "Puerto Rico's Debt Restructuring Process," available at https://oversightboard.pr.gov/debt/.

PREPA per month during the period of April 2021 to March 2022 alone. PRASA by itself accounts for $101 million of this amount.[128] Commonwealth agencies together account for another $37 million in accounts receivable, and other entities supervised by the FOMB account for about $2.5 million in unpaid balances as of March 31, 2022. **Table 4** summarizes PREPA accounts receivable from governmental and municipal entities under the FOMB's oversight.

Table 4: Summary Statistics for PREPA Accounts Receivable from Commonwealth Government and Municipal Entities Under the Oversight of the FOMB, April 2021 – March 2022

Entity	Account Code	Ending Balance as of March 2022	Average Monthly Bill	Average Monthly Unpaid Bill
Puerto Rico Aqueduct and Sewer Authority	CORP	$ 100,828,310	$ 12,219,194	$ 2,239,347
Commonwealth of Puerto Rico	AEST	$ 37,196,996	$ 12,390,692	$ 3,637,597
University of Puerto Rico (UPR)	CORP	$ 2,479,984	$ 2,141,176	$ (145,684)
Municipal Revenue Collection Center (CRIM)	AEST	$ 224,626	$ 72,994	$ 11,475
Public Corporation for the Supervision and Insurance of Cooperatives (COSSEC)	CORP	$ 1,842	$ 34	$ (23)
Puerto Rico Government Developing Bank	CORP	$ (9)	$ -	$ -
Puerto Rico Highway and Transportation Authority (HTA)	CORP	$ (228,661)	$ 222,210	$ (1,112,442)
Total:		**$ 140,731,748**	**$ 26,824,090**	**$ 5,742,712**

Note:
[1] Monthly unpaid bills are calculated as the monthly billed amount less the amount paid by the entity to PREPA each month.
Source:
[1] "Government Accounts Receivable March 2022.xlsx", FOMB_PREPA 00001467.

B. The FOMB's Revenue Envelope Should Assume That Government Entities Will Pay Their Unpaid Electricity Bills

120. PREPA's Plan of Adjustment assumes its continued inability to collect in full on unpaid bills owed by Commonwealth and other governmental entities. Assuming continued under-collection on unpaid electricity bills has the effect of reducing the Revenue Envelope available for debt service, and in the context of this proceeding asks PREPA's existing creditors

[128] *See* **Table 4**. Recently, PREPA and PRASA reached an agreement for certain payments by PRASA to PREPA in order to reduce PRASA's outstanding balance with PREPA. PREPA Governing Board, Resolution 5027, "Approval of a Memorandum of Understanding Between the Puerto Rico Electric Power Authority and Puerto Rico Aqueduct and Sewer Authority," February 24, 2023, available at https://aeepr.com/es-pr/jpportal/Resoluciones/Resolution%205027%20-%20Approval%20of%20a%20Memorandum%20of%20Understanding%20between%20PREPA%20and%20PRASA.pdf.

to pay for governmental customers' past electricity use in the form of lower recoveries. Moreover, the Plan's proponent—the FOMB—has supervisory authority over some of these delinquent entities and could require them to plan for, budget, and in fact make payments.

121. When pressed, some governmental entities have demonstrated their ability to make payments on unpaid balances owed to other service providers. For example, PRASA's 2022 Fiscal Plan describes an effort where it "worked jointly with the Government to reconcile balances of accounts receivable" owed to PRASA.[129] As a result, "PRASA's cumulative collections rate for government accounts from FY2018 to FY2022 averaged just over 100%, with total recovered amounts of $155 million over that time period."[130]

122. It is unreasonable and inconsistent with sound utility planning and practice for PREPA and the FOMB to assume that PREPA will have to recover these past-due amounts from other customers rather than from the governmental customers that owe the money to PREPA. It is unreasonable to assume that these new revenues would not be included in the amounts available to pay PREPA's existing customers as part of PREPA's revenue requirement.

[129] PRASA, "Puerto Rico Aqueduct and Sewer Authority 2022 Fiscal Plan," pp. 2-34, available at https://drive.google.com/file/d/1m3p6XwENAyNuELOb2ugncn9aGfK7n4mS/view.

[130] PRASA, "Puerto Rico Aqueduct and Sewer Authority 2022 Fiscal Plan," pp. 2-34, available at https://drive.google.com/file/d/1m3p6XwENAyNuELOb2ugncn9aGfK7n4mS/view.

Signed on the 28th day of April, 2023.

Susan Tierney

APPENDIX A
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Dr. Tierney, a Senior Advisor at Analysis Group, is an expert on energy economics, regulation, and policy, particularly in the electric and gas industries. She has consulted to businesses, federal and state governments, tribes, environmental groups, energy consumers, foundations, and other organizations on energy markets, economic and environmental regulation and strategy, and energy projects. Her expert witness and consulting services have involved wholesale and retail market analysis and design, contract disputes, resource planning and procurements, regional transmission organizations, the siting of electric and gas infrastructure projects, electric system reliability, utility ratemaking, carbon-emission-reduction policy, and other environmental policy and regulation. She has served as an expert in civil litigation cases and regulatory proceedings before state and federal agencies.

Previously, she served as the Assistant Secretary for Policy at the U.S. Department of Energy. She was the Secretary of Environmental Affairs in Massachusetts, where she was responsible for environmental regulation and natural resource protection. She was Commissioner at the Massachusetts Department of Public Utilities, Chairman of the Board of the Massachusetts Water Resources Authority, and Executive Director of the Massachusetts Energy Facilities Siting Council.

Dr. Tierney has authored numerous articles and spoken frequently at industry conferences. She serves on a number of boards and advisory committees, including chairing the Board of Resources for the Future. She is a trustee of the Barr Foundation and of the Alfred P. Sloan Foundation, a director of World Resources Institute, the Coalition for Green Capital, and the Climate Leadership Initiative, and an Advisor to the Trustees of the Oak Foundation. She is a member of the advisory councils at the New York University's Institute for Policy Integrity, and the New York Independent System Operator (NYISO). She is a member of the National Academies of Sciences, Engineering and Medicine's Committee on Accelerating Decarbonization in the United States, the Committee on Net Metering, and Climate Communications Initiative. She was a member of the NAS's Committee on The Future of Electric Power in the U.S., and on Enhancing the Resilience of the Nation's Electric Power Transmission and Distribution System. She chairs the External Advisory Council of the National Renewable Energy Laboratory (NREL) and previously chaired the Department of Energy's Electricity Advisory Committee. She was co-lead author of the energy chapter of the National Climate Assessment. She was Chair of Board of Directors of ClimateWorks Foundation, a member of the Board of the Energy Foundation, a member of the Columbia University's Center for Global Energy Policy Advisory Council, and a Visiting Fellow in Policy Practice at the University of Chicago's Energy Policy Institute, and served on the U.S. Secretary of Energy Advisory Board.

She taught at the Department of Urban Studies and Planning at MIT and at the University of California at Irvine, and has lectured at Harvard University, Yale University, New York University, Tufts University, Northwestern University, University of Chicago, and University of Michigan. She received NARUC's Mary Kilmarx Award in 2015, and in 2020 was designated as a National Associate of the National Research Council of the Academies of Sciences, Engineering and Medicine. She earned her Ph.D. and M.A. in regional planning at Cornell University and her B.A. at Scripps College.

EDUCATION

1980	Ph.D., regional planning, Cornell University
1976	Masters of Regional Planning, Cornell University
1973	B.A., art history, Scripps College *Studied political science at L'Institut d'Etudes Politiques, Paris, France*

PROFESSIONAL EXPERIENCE

2003–Present	Analysis Group, Inc., Boston, MA and Denver, CO *Senior Advisor (April 2014–Present)* *Managing Principal (July 2003–March 2014)*
1999–2003	Lexecon, Inc., Cambridge, MA (formerly The Economics Resource Group, Inc.) *Senior Vice President*
1995–1999	Economics Resource Group, Inc., Cambridge, MA *Principal and Managing Consultant*
1993–1995	U.S. Department of Energy, Washington, D.C. *Assistant Secretary for Policy*
1991–1993	Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Boston *Secretary of Environmental Affairs*
1988–1991	Commonwealth of Massachusetts, Department of Public Utilities, Boston, MA *Commissioner*
1984–1988	Commonwealth of Massachusetts, Energy Facilities Siting Council, Boston, MA *Executive Director*
1983–1984	Commonwealth of Massachusetts, Executive Office of Energy Resources, Boston, MA *Senior Economist*
1982–1983	Commonwealth of Massachusetts, Energy Facilities Siting Council, Boston, MA *Policy Analyst*
1982	National Academy of Sciences, Washington, D.C. *Researcher*
1978–1982	University of California at Irvine, Irvine, CA *Assistant Professor*

SELECTED CONSULTING EXPERIENCE

- **Various Confidential Engagements**
  Including power sales agreements, fuel contracts, investment strategy, project development, and other electric and gas industry matters.
- **Commonwealth Edison Company**
  Expert witness in support of ComEd's proposed grid modernization plan and multi-year rate case (2022-present).
- **Major Electric Utility**
  Analyzed the economic and policy implications of wholesale electricity market congestion (2022).
- **Zuni Tribal Council**
  Advisor on transmission line right-of-way compensation issues (2020-2022).
- **RISE Light & Power/Outerbridge New Jersey LLC**
  Co-author of report on the public benefits of the client's onshore transmission proposals to support the delivery of offshore wind into New Jersey (2021).
- **Pacific Gas & Electric Company, Southern California Edison, San Diego Gas & Electric Company**
  Witness ion policy issues related to reforms of the companies' net energy metering tariff (2021-2022).
- **Group of U.S. and European Foundations Funding on Climate Mitigation Issues**
  Work with China clean energy expert to analyze gaps in philanthropic funding on GHG mitigation in China (2021-present).
- **Coalition of CEOs of Investor-Owned Electric Utilities and Environmental Organizations**
  Project manager to support roundtable discussions on reducing greenhouse gas emissions in the U.S. power sector (2020-2022).
- **CMS Energy**
  Witness in support of CMS Energy's appeal before the Michigan Tax Tribunal (2020-2022).
- **Coalition for Green Capital**
  Co-authored a white paper on a new national green bank (2020-2021).
- **Pacific Gas and Electric Company**
  Conducted benchmarking study on investor-owned utilities' provision of wholesale distribution service and submitted testimony in PG&E's rate case filing on its wholesale distribution tariff (2020-present).
- **Santee Cooper**
  Prepared affidavit on states' electric industry structure (2020).
- **Major Electric and Gas Utility**
  Analyzed the impacts (e.g., on cost, GHG emissions, gas and electric system costs) associated with alternative strategies for shifting end-use consumers' non-electric energy uses to electricity (2019-2020).
- **La Plata Electric Association**
  Prepared testimony before the Colorado Public Utilities Commission regarding the complaints by La Plata Electric and United Power of the exit fee to be charged by Tri-State Generation and Transmission Association for La Plata's and United's potential withdrawal from the Tri-State system (2020).
- **Natural Resources Defense Council**
  Prepared a white paper on comments filed in the Federal Energy Regulatory Commission docket on whether to modify its Policy Statement related to certification of new gas pipelines (2019).
- **Delta-Montrose Electric Association**
  Provided testimony before the Colorado Public Utilities Commission regarding the complaint by Delta-Montrose of the exit fee being charged by Tri-State Generation and Transmission Association for Delta Montrose to withdraw from participation in the Tri-State system. (2019)
- **Transource**
  Provided testimony before the Maryland Public Service Commission regarding regulatory standards for reviewing transmission proposals that emanate from the regional transmission-planning process administered by a Regional Transmission Organizations. (2019)
- **New York ISO (NYISO)**

Prepared a white paper on the impacts on New York of the introduction of a carbon pricing mechanism into NYISO wholesale markets (2019).

- **Salt River Project**
  Wrote white paper on utility ratemaking processes and principles (2019).
- **Attorney General of New York State, on behalf of a coalition of state Attorneys General**
  Preliminary assessment of the U.S. Environmental Protection Agency's proposed Affordable Clean Energy (ACE) rule with changes in the New Source Review program (2018-2019).
- **Xcel Energy (Northern States Power - Minnesota)**
  Facilitated stakeholder meetings and outreach related to NSPM's integrated resource plan (2018-2019).
- **Commonwealth Edison (ComEd)**
  Provided expert testimony before the Illinois Commerce Commission on regulatory policy issues related to proposed pilot projects involved battery energy storage systems (2018).
- **Pacific Gas & Electric Company, San Diego Gas & Electric Company, Southern California Edison Company**
  Prepared white paper on a future structure for California's resource-adequacy and wholesale market structure in a low-carbon power system (2018).
- **Analysis Group, Inc.**
  Prepared a white paper about the rebound effect in estimating the impacts of changes in federal fuel economy and greenhouse-gas-emissions standards (2017-2018).
- **Merck Family Foundation**
  Analyzed the economic impacts of the Regional Greenhouse Gas Initiative's third compliance period (2015-2017) (2018).
- **Commonwealth Edison (ComEd)**
  Provided expert testimony before the Illinois Commerce Commission on regulatory policy issues related to a proposed microgrid pilot project (2017).
- **Natural Resources Defense Council**
  Prepared a white paper on changes in the natural gas industry since 1999 when the Federal Energy Regulatory Commission issued its Policy Statement related to certification of new gas pipelines (2017).
- **New York State Research and Development Administration**
  Provided support to NYSERDA and the New York Department of Public Service on issues relevant to the New York "REV" proceeding (2017-2019).
- **Hewlett Foundation**
  Supported strategy development for the Foundation's Environment Program (2017).
- **Advanced Energy Economy Foundation and American Wind Energy Association**
  Co-authored a white paper on wholesale power markets and system reliability and resilience (2017).
- **Entergy Vermont Yankee**
  Provided expert testimony before the Vermont Public Service Board on the public benefits of the proposed sale of Vermont Yankee to NorthStar (2016–2018).
- **Dominion Energy**
  Analyzed the implications for carbon emissions and consumer costs of a hypothetical shutdown of the Millstone Nuclear Station in Connecticut, and proposed testimony in support of Dominion filings before state agencies related to Millstone and a potential long-term power sales agreement for zero-carbon supply (2017–2019).
- **Protect the Granite State**
  Analyzed the economic implications of the proposed Northern Pass Transmission project for New Hampshire and New England (2017).
- **Environmental Defense Fund**
  Authored a white paper on challenges facing the U.S. coal industry in the 21st Century (2016).
- **Merck Family Fund**
  Co-authored a white paper on potential design issues relating to trading of carbon-emission credits between RGGI states and other states under the U.S. EPA's Clean Power Plan (2016).
- **Consolidated Edison and Southern California Edison**

Authored a white paper on the role of distributed energy resources in distribution utility planning and operations (2016).

- **Hawaii Gas Company**
  Provided expert testimony before the Hawaii Public Utilities Commission on issues related to the proposed merger of the Hawaii Electric Companies and NextEra (2015–2016).
- **The Energy Foundation and Merck Family Fund**
  Co-authored report on the economic impacts of the Regional Greenhouse Gas Initiative's (RGGI's) second three years of implementation during 2012–2014. (2015).
- **State of Delaware**
  Provided expert testimony before the Delaware Superior Court on issues related to the impact of the RGGI program on electricity customers and the economy in Delaware (2015–2016).
- **NEXUS Gas Transmission**
  Co-authored a report on the market for natural gas in the state of Ohio (2015).
- **Electric Power Supply Association**
  Co-authored a report for EPSA on the design of State Plans to align with organized wholesale markets in response to the U.S. Environmental Protection Agency's Proposed Clean Power Plan (2015).
- **Baltimore Gas and Electric, Pepco Holdings Inc. and PHI's affiliates Pepco, Delmarva Power, and Atlantic City Electric**
  Provided expert testimony before the Federal Energy Regulatory Commission on the need for and risks associated with transmission investment (2015).
- **Exelon Generating Company LLC**
  Analyzed alternative generation technologies and the consistency of Exelon's proposal to construct a natural-gas fired peaking unit with Massachusetts energy and environmental policies (2015).
- **The Energy Foundation**
  Co-authored reports on reliability issues related to the U.S. Environmental Protection Agency's proposed Clean Power Plan. (2014–2015).
- **New England Power Generators Association**
  Analyzed the impact of legislative proposals in Massachusetts to direct electric utilities to enter into long-term power supply agreements with Canadian hydropower companies. (2014, 2015).
- **Spectra Energy**
  Provided expert report in Maine regulatory proceeding related to the potential for the State of Maine to enter into a contract to support natural gas pipeline infrastructure in New England (2014).
- **The Energy Foundation and Merck Family Fund**
  Co-authored report on the consumer impacts of the U.S. EPA's proposed Clean Power Plan. (2014).
- **Exelon Corporation and Pepco Holdings, Inc.**
  Analyzed customer and state economic benefits of the proposed merger (2014–2015).
- **Major electric utility**
  Conducted independent review of the company's internal customer and shareholder analyses of long-term resource options (2014).
- **Major merchant generating company**
  Conducted valuation of assets (2014).
- **Entergy Wholesale Commodities**
  Provided strategic advice on wholesale and retail market issues in the Northeast power markets (2013–2016).
- **Hualapai Tribe**
  Provided strategic advice regarding energy resource development and valuation of electric transmission rights of way (2014–2018).
- **Barr Foundation**
  Prepared a report on the impacts of the Massachusetts Green Communities Act of 2008 on the Massachusetts economy. (2013–2014).
- **Five California Utilities (LADWP, PG&E, SCE, SDG&E, SMUD)**

Served on the four-person expert independent advisory panel for the third-party study of integration of renewable energy into California's Electric System. Contributed to report titled "Investigating a Higher Renewables Portfolio Standard in California" (2013–2014).

- **State of Colorado**
  Prepared expert report on behalf of the three public utility commissioners in Colorado, in support of the complaint against them on implementing Colorado's renewable energy standard under alleged violations of the interstate commerce clause (2013–2014).
- **Energy Foundation**
  Wrote white paper on the implications for electric system reliability of the Environmental Protection Agency's implementation of its authority under Section 111(d) of the Clean Air Act, to regulate greenhouse gas emissions from existing power plants (2013–2014).
- **Major engineering, construction and project management company**
  Prepared an expert report on electric market conditions in a dispute surrounding cancellation of a major power plant (2012–2017).
- **Ambri (battery company)**
  Analyzed energy system issues related to integration of renewables on a military base (2013–2014).
- **Advanced Energy Economy Institute**
  Facilitated workshop for state utility commissioners in Midwest states, on advanced energy technologies and related regulatory issues (2013).
- **Environmental Defense Fund – North Carolina**
  Testified on energy efficiency program design issues (2013).
- **Advanced Energy Economy Institute (with the New England Clean Energy Council and the New England Conference of Regulatory Utility Commissioners)**
  Supported workshop on advanced energy technologies and related regulatory issues (2013)
- **Lawrence Berkeley National Laboratory Energy Program**
  Provided regulatory policy support at the NJ Board of Public Utilities on smart grid workshop (2013).
- **Advanced Energy Economy Ohio**
  Provided testimony before the Ohio Senate Public Utilities Committee in support of the Ohio Energy Efficiency Resource Standard (2013).
- **Pepco Holdings Inc., and its operating affiliates, Potomac Electric Power Company, Delmarva Power & Light Company, and Atlantic City Electric Company**
  Provided testimony in support of appropriate incentives for investment in electric transmission (2013)
- **Baltimore Gas and Electric Company**
  Provided testimony in support of appropriate incentives for investment in electric transmission (2013).
- **Advanced Energy Economy Institute**
  Survey of CEOs of advanced energy companies doing business in California, with regard to the state's energy and environmental policies (2012–2013).
- **NSTAR and Cape Wind**
  Provided testimony in support of the long-term power contract of NSTAR and Cape Wind (2012).
- **Energy Foundation**
  Conducted strategic planning for the China Sustainable Energy Program (2012).
- **Pacific Gas & Electric Company**
  Provided testimony on ratemaking issues for PG&E's proposed pipeline safety enhancement plan (2012).
- **COMPETE Coalition**
  Provided testimony on energy efficiency as part of the performance of state and wholesale electric markets in New Jersey (2011).
- **Compressed Air Energy Storage Company**
  Confidential engagement to analyze regional wholesale markets for baseload and renewable energy power generation (2011).
- **Merck Family Foundation**

Analyzed the economic impacts of the funds collected through the auction of allowances under the Regional Greenhouse Gas Initiative (2011).

- **American Clean Skies Foundation Corporation**
  Analyzed the reliability and air emission issues associated with potential retirement of the Potomac River Generating Station (2011).
- **Colorado Public Utilities Commission**
  Analyzed the Colorado solar photovoltaic incentive program (2011).
- **Exelon Corporation and Constellation Energy (Baltimore Gas & Electric)**
  Analyzed the economic impacts on the Maryland economy associated with the proposed clean- energy commitments tied to the proposed merger of Exelon and Constellation Energy (2011–2012).
- **New England Power Generators Association**
  Analyzed competition issues in the proposed merger of Northeast Utilities and NSTAR (2011).
- **Dominion Generation**
  Analyzed the proposed state tax on output from in-state power generation (2011).
- **Exelon Corporation and Clean Energy Group**
  Analyzed electric industry issues involved in responding to the U.S. EPA's air regulations (2010-2015).
- **Major electric distribution company and independent power producer**
  Analyzed (modeled) the net benefits of retiring several generating units and replacing them with a long-term contract to provide power from a gas-fired power plant (2010).
- **Major electric utility company**
  Analyzed changing fuel-market conditions affecting the value of gas-fired power generation in the context of litigation (2010).
- **Commonwealth Edison Company**
  Analyzed the ratemaking issues for an electric distribution utility with respect to energy efficiency program effects in Illinois (2010–2011).
- **National Grid – Massachusetts electric distribution companies**
  Analyzed the market for the long-term contract for power from the Cape Wind project (2010).
- **Spectra Energy (with the Interstate Natural Gas Association of America)**
  Analyzed the markets for natural gas, and analysis of the implications of the U.S. EPA's Advanced Notice of Proposed Rulemaking on PCBs (2010–2011).
- **Renewable energy company**
  Analyzed transmission access, planning, cost allocation and siting conditions in US regions (2010-2011).
- **Indian tribe in Midwest**
  Analyzed the value of an oil pipeline right-of-way (2010).
- **Dominion Generation**
  Analyzed the proposed legislation in Connecticut to establish a windfall profits tax on all generating assets located in the state (2010).
- **Transmission consortium**
  Analyzed cost-allocation models for an interstate transmission project involving transmission utilities and merchant transmission companies (2009–2010).
- **Massachusetts renewable energy trust**
  Analyzed transmission-related approaches to the development of offshore renewable energy (2009).
- **Major electric utility**
  Developed business models and approaches for deploying energy efficiency within the context of the American Climate and Energy Security Act framework (2009).
- **Major industrial electricity consumer**
  Assisted in analyzing the implications of the American Climate and Energy Security Act for the company, in light of impacts on energy prices and trade considerations (2009).
- **National Grid**

Assisted in developing a revenue decoupling mechanism for retail distribution service, and testifying in electric and natural gas distribution rate cases in Massachusetts, Rhode Island, New York, and New Hampshire (2009–2011).

- **Sandia Pueblo**
  Assisted in valuing a transmission corridor on tribal reservation land (2008–2011).
- **Major electric and gas company**
  Provided analytic and strategic support for company's development of a business plan for energy efficiency and other energy-related investments on the customer side of the meter (2008).
- **AEP Transmission**
  Prepared a white paper on the design and cost allocation framework for a high-voltage transmission system designed to support renewable and other resources (2008).
- **Reliant**
  Prepared study assessing competition in the wholesale and retail electricity markets in ERCOT (2008).
- **Major environmental organization**
  Analytic and strategic support for utility ratemaking policies for advancing energy efficiency in many states (2008–2012).
- **New York Independent System Operator**
  Supported strategic planning and assessment for the Board of Directors (2008–2010).
- **Commonwealth Edison Company**
  Provided testimony on ratemaking policy issues relating to regulatory lag (2008).
- **Energy Association of Pennsylvania (EGA)**
  Analyzed of proposed legislation to cap retail electricity rates in Pennsylvania after the expiration of rate caps (2008).
- **National Association of Regulatory Utility Commissioners (NARUC)**
  Prepared study on best practices relating to state regulatory agency policies and utility practices on competitive procurement of resources to serve retail electricity customers (2007).
- **KeySpan/Boston Gas**
  Analyzed of the implications of utility ratemaking for valuation of utility assets for property taxation purposes (2008).
- **Electric company**
  Analyzed of state's retail and wholesale power market structure (2008).
- **Electric company**
  Prepared expert report on electric industry structure in the 1990s and 2000s (2007–2008).
- **Major electric company**
  Provided analytic support for company's development of strategic plan for company-wide GHG-reduction commitments (2008).
- **Sierra Pacific Power Company**
  Provided testimony on policy issues relating to the use of historic, future, and hybrid test years in state utility rate cases (2007–2008).
- **Harvard University**
  Provided strategic assistance relating to regulatory issues affecting the planning and design of Harvard's "green campus" development in Allston Landing (2007–2008).
- **Public Service Gas & Electric Company of New Jersey (PSEG)**
  Provided assistance in facilitating the development of a policy to address "leakage" of CO_2 emissions associated with the adoption of the RGGI cap-and-trade program (2007).
- **Electric Power Supply Association**
  Prepared white paper on economic, environmental, and regulatory trends in the electric industry (2007).
- **Sempra Energy Company – San Diego Gas & Electric Company and SoCalGas Company**
  Provided testimony on policy issues relating to the provision of financial incentives to electric and gas utilities for the successful provision of energy efficiency programs (2007).
- **PECO Energy Company**

Provided advice and testimony on various economic and policy issues relating to electric industry restructuring policy (2007).
Provided testimony on issues relating to the market for alternative energy credits and the proposal of PECO to voluntarily solicit, procure, and bank alternative energy credits (2007).

- **Commonwealth Edison Company**
  Provided testimony on issues relating to the relationship of auctions for wholesale supply for basic service customers and alternative proposals for utility resource procurement (2007).

- **ISO New England**
  Assisted in scenario planning for transmission and other alternatives (2006–2007).

- **PJM**
  Preparing report on market monitoring functions performed under various federal regulatory agencies with responsibility to oversee electricity and energy markets (i.e., the Federal Energy Regulatory Commission and the Commodities Futures Trading Commission) (2006–2007).

- **Major Industrial and Power Plant Company**
  Assisted company in analyzing market and negotiating the price and other terms and conditions for long-term gas supply and in valuing a power plant asset (2006–2007).

- **State of North Carolina**
  Provided expert witness services on electric utility economics and regulatory issues, on behalf of the Attorney General in a nuisance lawsuit to require the Tennessee Valley Authority to put in place air pollution control equipment on coal-fired power plants in TVA's system. (2006–2008)

- **Major Regional Transmission Organization**
  Performed analysis of market conditions and trends, and benchmarking market rules and reliability performance with other comparable organizations (2006–2007).

- **Special LNG Committee, Commonwealth of Massachusetts**
  Prepared *pro-bono* report on the need for natural gas and liquefied natural gas in the Northeast (2006).

- **Ute Indian Tribe of the Uintah and Ouray Reservation**
  Prepared a report on economic and policy issues relating to use of tribal lands for energy rights-of- way, as called for in Section 1813 of the Energy Policy Act of 2005 (2006).

- **New York ISO**
  Prepared white paper on fuel diversity issues in the New York market (2008).
  Prepared white papers on long-term contracting issues in states with restructured electric industries, and on the economic foundations for single-clearing-price markets versus pay-as-bid markets (2007).
  Performed economic benefit/cost study of wholesale competition into the region's wholesale electric market (2006–2007).

- **Commonwealth Edison Company**
  Provided testimony on appropriate ratemaking principles for recovery of pension-related costs in proceeding to set rates to go into effect following the transition period (2006).

- **Commonwealth Edison Company**
  Provided testimony on economic principles associated with single-price auction design versus pay- as-bid auction design (2006).

- **Exelon Corporation**
  Provided analysis of designs of mandatory carbon control policies (2005–2007).

- **Sonosky, Chambers, Sachse, Endreson & Perry, LLP, on behalf of various Indian Tribes**
  Provided analysis in support of comments filed with the Departments of Interior and Energy on energy rights of way on tribal land (as called for in Section 1813 of the Energy Policy Act of 2005) (2005–2006).
  Provided analysis in support of various tribal negotiations with energy companies with respect to valuation of energy rights of way on tribal reservation lands (2007).

- **Electric utility company**
  Performed independent evaluator services in procurement for power resources (2005–2006).

- **Power Generation Company**
  Provided analysis of product market development in MidWest and Eastern RTOs (2005).

- **New England Energy Alliance**

Prepared a white paper on energy infrastructure needs in the New England states (2005).

- **Committee on Regional Electric Power Cooperation (of the Western Interstate Energy Board)**
  Provided research on market monitoring for Western wholesale electric markets (2005–2007).
- **Southern California Edison Company**
  Provided Independent Evaluator services for a competitive procurement of new long-term generation resources and renewable resources (2005).
- **LNG / Interstate Gas Pipeline project – Duke Energy/Excelerate project**
  Prepared regional market study for the project proposed for Massachusetts (2004–2005).
- **Electric Generating Company**
  In a contract dispute, provided expert witness services relating to whether changes in a region's wholesale power market rules nullified a power sales agreement (2004–2006).
- **Louisville Gas & Electric and Kentucky Utilities**
  For two vertically integrated electric companies, provided expert witness services in a state investigation of which regional transmission approach satisfies state policy objectives (2004).
- **Independent Generating Company**
  For a power company owned by commercial lenders in a Northeast power market, provided consulting services to monitor state regulatory policies and actions affecting power plants (2004).
- **Major Electric and Gas Company**
  Performed confidential study of the benefits, costs and current conditions in certain wholesale and retail electric power markets (2004–2005).
- **Regional Transmission Organization**
  For a confidential project, analyzed market monitoring and mitigation approaches (2004–2005).
- **Major Commercial Bank**
  For a confidential project, advise with regard to electric industry restructuring and profitability of large energy marketer and trading organization (2004–2005).
- **Consumer Energy Council of America**
  For a group of electric industry market participants, regulators, and interest groups, prepared white papers on the need for transmission enhancements in U.S. power markets (2004).
- **Retail electric company**
  Provided confidential analysis of business models and regulation approaches for providing retail electric service in the state (2004).
- **Independent system operator**
  Provided confidential analysis and research on aligning retail and wholesale market policies (2004).
- **California State attorney general**
  Provided expert witness services with regard to state resource adequacy & planning practices (2004).
- **Pacific Gas & Electric Company**
  Provided expert witness services relating to the public benefits of the settlement between PG&E and the California Public Utility Commission, to enable PG&E to emerge from bankruptcy (2003).
- **Independent power company**
  Provided consulting advice on economics of compliance strategies for air and water permits (2003).
- **Major public utility company**
  Advised on the pricing and other terms for a long-term purchase power agreement (2003).
- **Duke Power**
  Provided expert advisory services relating to ratemaking and other regulatory practices (2003).
- **Exelon Generation**
  Provided strategic advice and analytic services relating to market conditions in New England (2003).
- **Entergy Services Inc.**
  Provided services as the independent monitor of Entergy's Fall 2002, Spring 2003 and Fall 2003 Requests for Proposals for Supply-Side Resources (2002–2005).
- **Power generation company in New England**

Provided expert testimony in contract dispute regarding allocation of uplift costs in an agreement concerning the supply of wholesale power for standard offer service (2002).

- **Connecticut Light and Power Company**
  Provided expert testimony in contract dispute regarding allocation of congestion costs in an agreement concerning the supply of wholesale power for standard offer service (2002–2003).
- **Ocean State Power**
  Provided arbitration services in a dispute regarding a gas purchase contract between Ocean State Power and ProGas Ltd. (2002–2003).
- **Regional independent system operator**
  Provided strategic advice on regional market trends and strategy (2002).
- **PJM Interconnection**
  Provided advice to the appointed mediator as part of the Alternative Dispute Resolution process, in a dispute involving PJM and a market participant (2002).
- **Duke Energy Corporation**
  Provided analysis on strategic issues in gas and electric regulatory policy for Duke Energy's corporate office, including with regard to code of conduct issues and wholesale competition (2001–2002).
- **Pacific Gas and Electric Corporation**
  Provided expert witness testimony in proceedings of the FERC on public benefits of the proposed restructuring of PG&E assets as part of its emergence from bankruptcy (2001–2002).
- **Massachusetts Renewables Trust**
  Provided assistance in support of the Trust's renewables and power quality program (2001–2002).
- **Major electric holding company**
  Prepared an analysis of the regulatory policies for reviewing merger applications in states where potential merger candidates are located (2001).
- **Western Massachusetts Electric Company**
  Provided expert testimony in contract disputes regarding allocation of congestion costs in agreements concerning the supply of wholesale power for standard offer service (2001–2002).
- **Energy Foundation**
  Researched and wrote a white paper on California's process for permitting new power plants (2001).
- **Cross-Sound Cable Company**
  Provided expert testimony regarding public benefits of proposal to construct merchant transmission facility across Long Island Sound (2001–2002).
- **Major independent power company**
  Served as expert witness in litigation surrounding power plant development project (2001–2004).
- **MASSPOWER Inc.**
  Served as Mediator in a contract dispute involving pricing of power purchases (2001).
- **NRG Energy and Dynegy**
  Provided expert witness support in regulatory proceeding to review these companies' acquisition of power plants being divested by Sierra Pacific and Nevada Power (2001).
- **Occidental Chemical Corporation**
  Served as expert witness on vertical market power in electric utility's transmission practices (2000).
- **PP&L Global**
  Provided economic and environmental analysis and expert witness support for proposal to build the Kings Park Energy power plant in Long Island, New York (2000).
- **Calpine Corporation**
  Provided economic and environmental analysis and expert witness support for the Wawayanda power project in Rockland County, NY and for the Towantic power plant in Oxford, Connecticut (2001).
- **American National Power, Calpine, El Paso, NRG Energy, Sithe, Southern Energy**
  Provided support for the development of a proposal for an RTO for New England (2000–2001)
- **Duke Energy/Maritimes and Northeast Pipeline**

Provided expert reports on the market and environmental impacts of new natural gas infrastructure and supply in New England (2000–2003).

- **Arkansas Electric Distribution Cooperatives and Arkansas Electric Cooperative Corporation**
  Served as expert witness on economic and public policy issues associated with wholesale and retail competition in Arkansas (2000–2001).
- **TransÉnergie U.S.**
  Served as expert witness on public benefits of a proposed merchant transmission facility (2000–2001).
- **Conectiv**
  Provided strategic wholesale market analysis and support for procurement of supplies for distribution utility company's provision of Basic Generation Services to retail customers (2000).
- **SCS Energy Corp. – Astoria Energy**
  Served as expert witness for proposal to build new power plant in New York City (2000–2001).
- **HEFA Power Options**
  Provided strategic advice regarding wholesale power market for retail buyers' group (2000–2003).
- **Major real estate development company**
  Provided analysis of electric and gas infrastructure for large mixed-use development (2000–2001).
- **Investment company**
  Provided strategic advice to investment company with regard to potential investment in major electric generating equipment manufacturing company (2000)/
- **Major independent power company**
  Provided economic and environmental support for company's application to construct a merchant power plant in Florida (2000).
- **Major railroad company**
  Provided expert witness support on economic and regulatory policy issues for railroad in state regulatory proceeding on a proposed utility merger (2000).
- **Coalition of Wireless Telecommunications Carriers**
  Prepared an expert report on economic benefits of wireless telecommunications (2000).
- **Major brownfield property developer**
  Provided valuation of property as a site for new electric generating facility (2000).
- **Fitchburg Gas and Electric Company**
  Provided litigation support for a gas and electric company on rate design policy (2000)/
- **Consortium of electric companies**
  Provided economic analysis, contract review, and litigation support for a consortium of electric companies with power purchase agreements with PURPA projects (1999).
- **FirstEnergy Corp.**
  Provided expert witness support regarding generation asset valuation and the impacts of a new electric industry restructuring law on the company (1999–2000).
- **Ozone Attainment Coalition**
  Provided strategic analysis and advice on electric system reliability issues relating to electric companies' implementation of 2003 NOx requirements issued by the U.S. EPA (1999).
- **Municipal electric department**
  Provided expert witness services and analysis of the economics and need for a new natural gas pipeline proposed to serve an existing electric power plant in Massachusetts (1998–2001).
- **Seneca Nation**
  Provided expert analysis and strategic advice regarding the value of transmission rights of way, in a dispute with an electric utility company (1998–2000).
- **Major cable company**
  Provided strategic advice in a series of regulatory and court cases involving inter-affiliate transactions of electric utility company entering into competitive telecommunications and cable markets (1998).
- **Major electric utility company**

Provided expert witness support regarding structural changes in the electric industry, in litigation pertaining to the company's restructuring plans (1998–1999).

- **Sithe Energies, Inc.**
  Provided strategic advice and regulatory support on a variety of issues (market analysis, transmission and ISO issues, federal and state market rules, legislation, siting, environmental strategy) relating to the company's participation in the New England, New York, and PJM markets (1997–2003**).**
  Provided transition assistance to the company in its acquisition and integration of approximately 2,000 MW of existing fossil fuel generation from Boston Edison Company (1997–1998).
  Provided transition assistance to the company in its acquisition and integration of approximately 4,100 MW of existing fossil and hydroelectric generation capacity from GPU Genco (1998–1999).
  Provided support for the company's participation in electricity product markets under development in New England, New York and PJM (1997–2002).
  Provided strategic project development advice and expert witness support for the company's applications to construct three natural gas merchant power plants (totaling 2865 megawatts) in Everett, Weymouth, and Medway, Massachusetts. (1998–2001)
  Provided strategic guidance and regulatory support regarding design of air quality improvement plan for existing fossil units at Mystic Station. (1998–2001)
  Provided strategic guidance regarding company's natural gas-fired merchant power plant development projects in Ontario, Canada (2000–2001).

- **Natural Resources Canada**
  Prepared a white paper on the implications for electric system reliability in Canada that are associated with restructuring the electric industry in the United States (1999).

- **Cummins Engine Company, Inc.**
  Provided strategic analysis on implications of national energy and environmental policies for the Company's long-term business opportunities (1999).

- **Electric utility company**
  Provided advice and regulatory support with regard to the economics and prudency of an existing long-term power purchase agreement (1998).

- **National Association of Regulatory Utility Commissioners (NARUC)**
  Assisted the Executive Director and NARUC leadership in updating its strategic plan and in preparing a business plan for its implementation (1998).

- **State energy office**
  Assisted in analyzing options for supporting renewable resource development in the state and in designing a market-based strategy to implement a new renewables portfolio standard (1997–1998).

- **U.S. Generating Company (PG&E Generating Company)**
  Provided analysis of and testimony on the economic, reliability, and environmental benefits to the host state and region of a new merchant power generation facility: the 360-megawatt Millennium project in Massachusetts (1996–1997).
  Provided analysis of and testimony on the economic, reliability, and environmental benefits of a new merchant power generation facility: the 792-megawatt Lake Road Generating Project in Connecticut (1997–1998).

- **Pennsylvania Power & Light Company**
  Provided strategic guidance, economic and policy analysis, and regulatory support for electric utility company as it developed and proposed its plan for restructuring its company for retail competition. Provided expert witness testimony on rate design policy issues (1996–1998).

- **Major diversified electric equipment company**
  Provided strategic advice and analysis on market opportunities and risk in various regions of the U.S. electric industry, under numerous restructuring scenarios (1996–1997).

- **Major nationwide electricity consumer**
  Conducted analysis of buying options and strategies for acquisition of electricity services in states with customer choice in retail generation markets (1997).

- **National Council on Competition in the Electric Industry**
  Prepared a Briefing Paper on Regional Issues in Electric Industry Restructuring, for the NCCEI – a joint project of the National Association of Regulatory Utility Commissioners, the National Conference of State Legislatures, the U.S. DOE and the U.S. EPA (1997).

- **Major western coal company**
  Analysis of western states' electric industry restructuring policies and market prices for power in various states within the Western Systems Coordinating Council area (1996–1997).
- **Major gas pipeline company**
  Provided analysis of market structures and prices for generation and delivery services in electric service territories where the gas pipeline would locate facilities that use electricity (1997).
- **Major electric supply company**
  Provided analysis of regional electricity market conditions to support the company's analysis of the value of various utility assets that were being divested as part of corporate restructuring (1997).
- **Massachusetts Division of Energy Resources**
  Analyzed Boston Gas Company's proposal for unbundling its retail service, its proposal for performance-based rates, and its plan for departing the merchant function (1996–1998).
- **Massachusetts Division of Energy Resources**
  Assisted the state's energy office in developing policies for establishing a statewide fund to support renewable resource development as part of the state's electric industry restructuring plan (1997).
- **Massachusetts Water Resources Authority Advisory Board**
  Analyzed opportunities for use of the Authority's energy-using and -producing assets, to position itself beneficially as a participant in a restructured retail electricity market in New England (1996–1997).
- **Coalition of marketers and independent power producers**
  Analyzed state regulatory proposals for restructuring the electric industry (1996–1997).
- **Major independent power producer**
  Analyzed market opportunities and risks for merchant plant development in a U.S. region (1996).
- **Major independent power producer**
  Analyzed the expected market price of power in two regions of the U.S. electricity markets (1996).
- **Group of municipal electric companies in New York State**
  Served as expert witness on cost allocation issues in litigation on wholesale power contracts (1996).

TESTIMONY IN LAST FOUR YEARS

- **Many confidential expert reports, testimonies, declarations, affidavits, and depositions.**

- **On behalf of Commonwealth Edison Company**
  Before the *Illinois Commerce Commission*, Order Requiring Commonwealth Edison Company to file an Initial Multi-Year Integrated Grid Plan and Initiating Proceeding to Determine Whether the Plan is Reasonable and Complies with the Public Utilities Act and Verified Petition for Approval of a Multi-Year Rate Plan under Decision 16-108.18 of the Public Utilities Act, Consolidated Dockets No. 22-0486 and 23-0055, 2021, Direct Testimony, January 17, 2023.
- **On her own behalf**
  Before the F*ederal Energy Regulatory Commission*, Technical Conference on Greenhouse Gas Mitigation: Natural Gas Act Sections 3 and 7 Authorizations," Docket No. PL21-3-000, November 19, 2021.
- **Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company**
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"Wholesale Electricity Markets," National Governors Association, September 23, 2021.

Expert Panel on "Greenhouse Gases - Where are they from, why do they matter, and can they be reduced?" America in One Room: Climate and Energy - Deliberative Polling Event (Stanford University), September 2021.

"Improving Electricity Transmission Siting Opportunities to Meet America's Consumer, Economic, Clean Energy and Climate Goals," Progressive Policy Institute, September 14, 2021.

"Energy Transitions: Agency of Change, Changing Agents," UT Energy Week, 2021, University of Texas Energy Institute, April 2021.

Briefings on the National Academies' study on The Future of Electric Power, February-March 2021.

Briefings on the National Academies' study on Decarbonizing the U.S. Energy System, February-March 2021.

"Wholesale Electricity Markets: Resource Adequacy," Future Power Markets Forum, Johns Hopkins and Columbia University Center for Global Energy Policy, February 5, 2021.

"Wholesale Power Market Design in a Future Low-Carbon Electric System," WRI-RFF Workshop, December 16, 2020, https://www.rff.org/events/workshops/market-design-for-the-clean-energy-transition-advancing-long-term-approaches/.

"Introduction to the Theory and Practice of Regulation: The Coming Utility Transition," NRRI Regulatory Training Initiative," November 9, 2020, https://www.youtube.com/watch?v=OqVv1KEK5ko.

"Opportunities for Governors to Leverage or Align Electricity Markets to Meet State Energy Goals," National Governors Association, October 29, 2020, https://www.nga.org/center/meetings/strategies-meet-clean-energy-goals/ .

"New York's Path to a Carbon Free Future," City and State New York, September 17, 2020, https://www.cityandstateny.com/events/nys-path-carbon-free-future.

"Energy Stimulus: Investing in the Power Grid of the Future," Irving Institute, Dartmouth College, July 14, 2020.

"The Future of Natural Gas in New England's Electric System? Who knows; It's complicated," New England Electricity Roundtable, June 12, 2020. http://www raabassociates.org/main/roundtable.asp?sel=155.

"The NYISO's Carbon Pricing Proposal: Value Proposition to New York," Energy Policy Roundtable in the PJM Footprint, panel on carbon pricing, April 28, 2020. http://pjm.raabassociates.org/main/roundtable.asp?sel=159.

"Decarbonizing the Electric Power Sector," Center for Strategic and International Studies, March 30, 2020. (podcast) https://www.csis.org/events/audio-event-decarbonizing-electric-power-sector.

"Making Sense of FERC's MOPR Order," Resources for the Future Workshop, January 22, 2020.

"CEO Roundtable: The New England Investment Thesis," moderator of panel at the New England Power Generator Association's Summit, Boston, December 2, 2019.

"Government Policies Promoting Low Carbon Transitions," moderator of panel at the U.S. Association of Energy Economists, Denver, November 5, 2019.

"A Transformation of Power: The U.S. Electric Grid Undergoes Change," Energy Journalism Initiative, Center for Global Energy Policy, Columbia University, New York City, June 12, 2019.

"Trends and Issues in the Electric Industry – and Potential Implications for State AGs," New York University State Energy & Environmental Impact Center, Washington, DC, May 29, 2019.

"Electric System Planning: Mapping Opportunities for Participation by State Air Offices," National Association of Clean Air Agencies, Webinar, April 4, 2019.

"Emerging Energy and Environmental Technologies: Possibilities, Policy Implications, and Potential Consequences," Resources for the Future/Alfred P. Sloan Foundation Conference on Energy Research Insights for Decision making, Washington, DC, November 29, 2018.

"The Energy 202 Live: Powering a Cleaner and Brighter Future," Washington Post Live, November 28, 2018.

"Energy Policy: Research and analysis in an era of disruptive change," Keynote Address, Energy Policy Research Conference, Boise State University Energy Policy Institute, Boise, Idaho, September 6, 2018.

"Transitions to a Low-Carbon Electric Supply," EEI CEO meeting, Colorado Springs, September 5, 2018.

"Potential Solutions & Discussions, NERC (North American Electric Reliability Corporation), Technical Workshop on Gas Infrastructure Risk and Associated Recommendations, Atlanta, July 10, 2018.

"Economic Approaches to Understanding and Addressing Resilience in the Bulk Power System," Resources for the Future and R Street Institute Workshop, Washington, D.C., May 30, 2018; webinar, June 18, 2018.

"The Future of Nuclear Power," The Council of State Governments/Eastern Regional Conference, Northeastern Legislative Climate and Energy Summit, Andlinger Center for Energy and the Environment, Princeton University, May 11, 2018.

"The Energy 202 Live: Energy Investment for Today and Tomorrow," Washington Post Live, May 10, 2018.

"State Policies and Proposals to Support Existing Nuclear Power Plants," Center for Climate and Energy Solutions, Washington, DC, May 9, 2018.

"The Energy 202 Live: Energy Investment for Today and Tomorrow," Washington Post Live, May 10, 2018.

"The Fracking Debate: The Pros, Cons, and Lessons Learned from the U.S. Energy Boom," Energy Policy Institute of Chicago, University of Chicago, April 11, 2018.

"Power Sector Transformation: Natural Gas/Electricity Panel," Annual Meeting of the Joint Institute for Strategic Energy Analysis, National Renewable Energy Laboratory, April 5, 2018.

"The Evolution of Utility and Regulatory Reform in the U.S.," 2018 e21 Forum #1: Toward a 21st C. Electric System in Minnesota, March 20, 2018.

"The Natural Gas/Electricity Nexus," Keystone Energy Board meeting, Keystone CO, February 9, 2018.

"Critical Aspects of Transitioning to Competitive Energy Markets from a Wholesale and Retail Perspective & Renewable Energy Procurement in Restructured Markets," Committee on Energy Choice, State of Nevada, Las Vegas, November 7, 2017.

"Firm With Trump Cabinet Ties Scores $300M Puerto Rico Power Contract," On Point radio show on restoration of Puerto Rico's electric grid, WBUR/NPR, October 25, 2017.

"Beyond Baseload? Electricity Markets and Reliability," Keystone Energy Board meeting, Washington, D.C., October 24, 2017.

"The Future of Baseload in the West," Committee on Regional Electric Power Cooperation (CREPC), Reno, October 17, 2017.

"Regulatory Paths Forward for a Clean Grid," Harvard Law School, Cambridge, October 13, 2017.

"This Thing about Coal and Nukes," Grid Geeks Podcast, October 6, 2017.

"What Do Americans Think about the Direction of Energy and Climate Policy?" EPIC, University of Chicago, October 4, 2017.

"Preparing for the Future: Challenges and Opportunities of Modernizing the Grid," NextGrid Illinois conference, Chicago, September 28, 2017.

"Designing America's Energy Future," National Renewable Energy Laboratory's 40th Anniversary meeting on energy innovation, Golden, CO, September 20, 2017.

"The Future of Power Markets in a Low Marginal Cost World: Electricity Sector Overview," Resources for the Future, September 14, 2017.

"The National Academy of Sciences Report on Electric System Resiliency: Natural Gas and Electric System Interdependencies," NAESB, September 7, 2017.

"Valuing Distributed Energy Resources," Aspen Energy Policy Forum, July 2017.

"The Road from Paris: A Conversation with the Former Secretary of Energy Ernie Moniz," Aspen Ideas Festival, July 2017.

"How Policy Choices Today Will Impact the Future of Electric Power," Edison Electric Institute, Annual Meeting, Boston, MA, June 12, 2016.

"Big Think Presentations on the Future of Retail Electricity Service," California Public Utilities Commission and California Energy Commission, Joint En Banc on Changing Nature of Consumer and Retail Choice in California, Sacramento, CA, May 19, 2017.

"Energy Resources: The Right Mix – or Mix It Up? Is What We Need Compatible With The Region's Energy Goals?" Northeast Energy and Commerce Association, Mystic, CT, May 10, 2017.

"Comments at the FERC Technical Conference on Certain Matters Relating to State Policy Initiatives Affecting Wholesale Energy and Capacity Markets Operated by Eastern Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs)," Washington, D.C, May 2, 2017.

"Utility of the Future: Valuing Distributed Energy Resources," Electric Power Research Institute (Research Advisory Committee), Tempe, AZ, March 7, 2017.

"Navigating the Energy and Environmental Policy Landscape," Nicholas School for the Environment, Duke University, Washington, D.C, February 15, 2017.

"What is Next for the EPA's Carbon Regulations for Existing Power Plants?" NARUC Electricity Committee and the Energy Resources and the Environment Committee, Washington, D.C., February 14, 2017.

"Carbon: A risk or an opportunity?" NARUC Energy Resources and the Environment Committee, Washington, D.C., February 14, 2017.

"Managing the Energy Transition: Exploring Pathways to Deep Decarbonization," Bipartisan Policy Center, Washington, D.C., December 8, 2016.

"The Clean Power Plan and Beyond: What to Expect in 2017…" NYU School of Law – Institute for Policy Integrity, New York, NY, November 15, 2016.

"Location, Location, Location, and the Value of Distributed Energy Resources," NARUC Annual Meeting, La Quinta, CA, November 14, 2016.

"Value of 'DER' to 'D': The role of distributed energy resources in local electric distribution system reliability," Presentation to NARUC Committee on Electricity, November 14, 2016, La Quinta, California.

"State Electric Industry Policies and Organized Wholesale Electricity Markets," Presentation to the NYISO Environmental Advisory Council, Albany, NY, November 4, 2016.

"Existing nuclear units and potential policy solutions: Approaches in other states beyond Illinois," Chicago, IL, October 18, 2016.

"Existing Nuclear Units – and New York's Clean Energy Standard," presentation to the NARUC Energy Resources and the Environment Committee – Monthly Conference Call, September 16, 2016.

"Understanding the Evolving Trends in the Eastern Interconnect: Implications for Environmental Policies & Investments," Duke Nicholas Institute for Environmental Policy Solutions/Great Plains Institute/Bipartisan Policy Center, I, Atlanta, September 13, 2016.

"What does the U.S. need to do to meet its climate goals? Why Nuclear? How Much and How Fast?" Aspen Institute Forum on the Future of Nuclear Energy, Aspen, August 10, 2016.

Testimony of Susan F. Tierney, Ph.D. Before the Democratic Platform Committee, U.S. Progress on Clean Energy Policy, Phoenix, June 17, 2016.

"Value of "DER" to "D": The Role of Distributed Energy Resources in Local Electric Distribution System Reliability," presentation to the MidAtlantic Conference of Regulatory Utility Commissioners (MACRUC), Williamsburg, VA, June 21, 2016.

"How does New Jersey Achieve a Low-Carbon Future?" New Jersey Spotlight conference, Trenton, NJ, June 3, 2016.

"Potential federal and state actions that could help address financial risks facing many existing nuclear power plants," U.S. Department of Energy's Summit on Improving the Economics of America's Nuclear Power Plants, Washington, D.C., May 19, 2016.

"New England's Electricity 'Restructuring:' Successes, disappointments, and what's next," 150th meeting of the New England Electricity Restructuring Roundtable, Boston, MA, May 18, 2016.

"Clearing the Way: Pioneering New York's Clean Energy Standard," Albany, NY, May 11, 2016.

"Electricity markets in transition," Annual Energy Summit of Columbia University's Center for Global Energy Policy, New York, NY, April 27, 2016.

"Value of "DER" to "D": The Role of Distributed Energy Resources in Local Electric Distribution System Reliability," California Public Utility Commission's "Thought Leaders Forum," April 21, 2016.

"Transforming Power Systems: Challenges and Solutions," Annual meeting of the Joint Institute for Strategic Energy Analysis, NREL, Golden, CO, March 31, 2016.

"Background and Context: Eras of Electric Utility Industry (in 5 Minutes!)," New Orleans City Council/ Entergy New Orleans Electricity Symposium, March 22, 2016.

"Affordability, Cost Containment, and Economic Development: Complying with the Clean Power Plan," 3-N meeting (NARUC, NASEO, NACAA) on How State Agencies Are Working Together, Washington D.C., February 11, 2016.

"Evaluating Clean Power Plan Pathways in a Dynamic Electricity Sector," Conference on Navigating the EPA's Clean Power Plan: Charting a Course for the Southeast, sponsored by Duke University Nicholas Institute for the Environment, Orlando, January 28, 2016.

NASEO/DOE/EIA, "2015 – 2016 Winter Energy Outlook Conference," National Press Club, Washington, D.C., October 6, 2015.

"Outlook for Energy," Clinton Foundation Global Initiative, New York, NY, September 28, 2015.

"Reactions to the Clean Power Plan," NARUC Electricity Committee, Arlington, VA, August 14, 2015.

"Trends in national climate policy," Institute for Sustainable Cities, June 18, 2015.

"EPA's Clean Power Plan and its potential effects on system reliability," Mid-American Regulatory Commissioners (MARC) Conference, Milwaukee, June 8, 2015.

"Proposed Reliability Mechanisms for the Clean Power Plan," Bipartisan Policy Center Workshop, National Press Club, Washington D.C., May 9, 2015.

"EPA's Proposed Clean Power Plan: Testing the tires, looking under the hood… How far does it take us toward a clean, modern electric system?" Cornell University, Ithaca, NY, November 2014.

"Readying States for New Greenhouse Gas Rules in the Electricity Sector," National Governors Association – Workshop for Governors' Energy Advisors, Washington, D.C., September 22, 2014,

"Natural Gas and Renewable Energy Synergies: Challenges and Opportunities," North American Energy Standards Board (NAESB), Board Meeting, Houston, September 10, 2014.

"America's Electricity Evolution: New Policies, Regulations, and Technologies Converging to Change the Future of Power Production and Use," 2014 NASEO Annual Meeting, Savannah, September 2014.

"Implications for Energy, Economy, and Environment Under the Proposal," Environmental Council of the States (ECOS), Washington D.C., July 31, 2014.

"Regional Options and Strategic Choices," NARUC Workshop on Regional Compliance Options for Sec. 111d, Washington D.C., July 28, 2014.

"111d in Big D: Compliance Options, Regional Approaches, and Where We Go from Here," NARUC, Dallas, July 16, 2014.

"The National Climate Assessment: What Risks Lie Ahead for the Energy Sector?" NARUC, Dallas, July 14, 2014.

"The EPA's new Clean Power Plan proposal: Some suggestions for state action now," National Association of Clean Air Agencies, Washington, D.C., July 13, 2014.

"Changing electric industry dynamics: The role of regulation," Aspen Institute Energy Policy Forum: Electricity Structure and Regulation, July 7, 2014.

"Natural Gas and Renewable Energy Synergies: Challenges and Opportunities," Synergies of Natural Gas and Renewable Energy: 360 Degrees of Opportunity, Center for the New Energy Economy (CNEE), Joint Institute for Strategic Energy Analysis (JISEA), Gas Technology Institute (GTI), Bloomberg New Energy Finance, New York, NY, July 1, 2014.

"EPA's Clean Power Plan," Bipartisan Policy Center, June 18, 2014.

"GHG Emission Reductions From Existing Power Plants Under Section 111(d) of the Clean Air Act: Options to Ensure Electric System Reliability," Electricity Advisory Committee, U.S. Department of Energy, May 8, 2014.

"Climate Solutions: The role of existing nuclear power," Center for Climate and Energy Solutions, Washington, D.C., April 28, 2014.

"Electric Power Systems: The Outlook for Electric Transmission: Where You Stand Depends Upon Where You Sit," Harvard Law School, March 20, 2014.

"Section 111(d) of the Clean Air Act: Drivers of Power Sector CO2 Reductions," Bipartisan Policy Center Workshop on GHG Regulation of Existing Power Plants under the Clean Air Act: Policy Design and Impacts, Washington, D.C., December 6, 2013.

"The World of Abundant Natural Gas in the U.S.: Looking Ahead for Power-Sector Implications," presentation to the Keystone Energy Board, Washington, D.C., October 30, 2013.

"Energy: From the Last to the Next 150 years," keynote address to the Energy Forum of Boston College's Sesquicentennial Celebration, October 25, 2013.

"Capacity Markets in the Northeast: A Preview of Comments at the FERC Technical Conference on Centralized Capacity Markets in RTOs/ISOs," presentation to the Independent Power Producers of New York, Saratoga Springs, New York, September 10, 2013.

"Opportunities and Risks of Shale Gas Development," presentation to the Governors' Policy Forum on Shale Energy Development, National Governors Association, Denver, September 9, 2013.

"The National Climate Assessment (Draft): Chapter on Energy Supply and Use," presentation to the National Association of Regulatory Utility Commissioners, Denver, July 23, 2013.

"Climate Change Preparedness in New Jersey: Utilities – Leading Practices and Trends Nationally," presentation to the New Jersey Climate Adaptation Alliance, Rutgers University, May 21, 2013.

"Is New England Over-Reliant on Natural Gas?" presentation to the 20th Annual Energy Conference of the Northeast Energy and Commerce Association, Groton CT, May 21, 2013.

"Jevons' Boomerang: Is the rebound effect real? If so, is the effect negative or positive?" presentation to the EE Global Conference, Washington, D.C., May 20, 2013.

"Framing the Issues: Growing Tensions at the Interface of the Natural Gas and Electric Industries," presentation to the MIT Energy Initiative (MITEI) Symposium on "Growing Concerns, Possible Solutions: Gas/Electric Interdependence," April 16, 2013.

"Unconventional Natural Gas: The Fracking Debate," Northeast Gas Assn, Providence RI, March 15, 2013.

"Unconventional Natural Gas: Trends, Opportunities, and Challenges with America's New Energy Resource, Center for the American West series on "FrackingSENSE: What We Know, What We Don't Know, and What We Hope to Learn about Natural Gas Development," Boulder, Colorado, March 5, 2013.

"Global Energy Security: Upcoming challenges and opportunities (from a U.S. vantage point)," Tufts University Energy Conference – Powering Global Energy Security, Medford, Massachusetts, March 3, 2013.

"Old Made New – Conventional Resource Innovation in the 21st Century," MIT Energy Conference, Boston, March 2, 2013.

"The Evolving Energy Landscape: Standing at the Crossroads in 2013," Keynote Address, Kellogg School of Management Energy Conference, Northwestern University, Chicago, February 13, 2013.

"The Starting Point: Interconnection/Grid Planning in the Face of Diversity, Technical Complexity, Uncertainties, Challenges, Opportunities," NARUC/DOE, Washington D.C., February 6, 2013.

"Electric Power Systems: The Outlook for Electric Transmission: Where You Stand Depends Upon Where You Sit," Yale University School of Forestry/Management, February 5, 2013.

"Electric Power Systems: The Outlook for Electric Transmission: Where You Stand Depends Upon Where You Sit," New York University Law School, February 4, 2013.

"The Future of Energy," DOE Energy All Stars, Department of Energy, January 19, 2013.

"The Economic Impacts of RGGI's First Three Years," Columbia University Law School – Center for Climate Change Law, Conference on the Future of the Regional Greenhouse Gas Initiative, New York, City, October 22, 2012.

"Reality Check on Energy Conditions," New Hampshire Energy Summit, Concord, NH, October 22, 2012.

Natural gas and renewables: Curious bedfellows," Renewable Energy Law & Policy Summit, University of Denver Sturm College of Law, October 19, 2012.

"Smart Grid and Air Emissions," Gridweek, Washington D.C., October 4, 2012.

"C3E Women in Clean Energy Symposium," Keynote Address, Boston, September 28, 2012.

"Natural Gas: Risks and Opportunities – Shale Gas, Hydraulic Fracturing, and Other Facts," EPA Region 1 seminar, Boston, MA, September 27, 2012.

"Finding the Sensible Middle: Policies and Institutional Roles in Unconventional Gas Development," Unconventional Gas Research Forum, Board on Energy and Environmental Systems, National Academy of Sciences, Washington D.C., September 11, 2012.

"Unlocking the Potential of Regional Collaboration," California ISO Stakeholders Symposium, Sacramento, September 6, 2012.

"The Context for Compliance with EPA Air Regulations: Power Market Conditions," EPA/DOE/NETL/ EPRI/AWMA Power Plant Air Pollution Control Mega-Symposium, Baltimore, August 20, 2012.

"Finding the Sensible Middle: Unconventional Gas Development," 24th Annual Natural Gas Strategy Conference & Executive Forum, August 15, 2012.

Intelligence Squared U.S. debate: "No fracking way: The natural gas boom has done more harm than good," against the proposition (with team mate, Joe Nocera (*New York Times*)), Aspen, Colorado, July 1, 2012.

"What, Me, Worry? The New Outlook for Natural Gas in New England - How Will Natural Gas Impact

New England's Electricity Markets and Reliability," New England Restructuring Roundtable – June 15, 2012.

"China's Energy Challenges and Policy Responses: Observations from a U.S. Vantage Point," Connecticut College Vietnam Program, June 15, 2012.

"Economic Impacts of RGGI: Following the Dollars," presentation to the RGGI Board, June 2012.

"The Energy Scene: Update on a Few Key Issues," presentation to the Ozone Transport Commission, April 23, 2012.

"Shale Gas: Analyzing Risks and Opportunities," Society for Risk Assessment, Boston University, April 9, 2012.

"Sustainable Energy Highway," New York State Energy Highway Summit, April 4, 2012.

"Electric and Natural Gas Markets – Interactions, Opportunities, Challenges (with a focus on Texas)," Gulf Coast Power Association Spring Meeting, April 3, 2012.

"Natural Gas: Risks and Opportunities – Shale Gas, Hydraulic Fracturing, and Other Facts," Tufts University – Fletcher School, March 29, 2012.

"Fracking and Shale Gas, Part I: Impacts on Energy Markets and Massachusetts," Boston Bar Association, March 6, 2012.

Electric Power Systems: "The Outlook for Electric Transmission: Where You Stand Depends Upon Where You Sit," Harvard Law School, February 16, 2012.

"Natural Gas: Policy Recommendations of the NPC, SEAB, and BPC," Energy, Utility and Environment Conference 2012, January 30, 2012.

"Economic Impacts of RGGI: Following the Dollars," Energy, Utility and Environment Conference 2012, January 30, 2012.

"Electric Power Systems: "The Outlook for Electric Transmission: Where You Stand Depends Upon Where You Sit," Yale University School of Forestry and Environmental Studies, January 24, 2012.

"U.S. Renewable Energy Policy: Overview, with comparisons to European approaches," presentation to the Wharton School, January 3, 2012.

"The Truth about Fracking," presentation to the New York Energy Forum, December 19, 2011.

"The Clean Energy Economy," presentation to the Environmental Lawyers, Environmental League of Massachusetts," November 30, 2011.

"Outlook for the Electric Generating Fleet: Effects of the Upcoming EPA Regulations," presentation to the Harvard Kennedy School Energy Policy Series, November 28, 2011.

"The National Petroleum Council's "Prudent Development: Realizing the Potential of North America's Abundant Natural Gas and Oil Resources," NARUC Annual Meeting, St. Louis, November 15, 2011.

"The Future of U.S. Energy Policy: What happens when we assume no changes in the near term…?" Wharton Energy Conference – Energy Frontiers: A Global Perspective, Philadelphia, October 28, 2011.

"Natural Gas: Risks and Opportunities (*with an emphasis on shale gas developments)," Harvard University Center for the Environment – Future of Energy Series, Cambridge, October 26, 2011.

"An Expanded Toolkit – Environmental Regulations, Natural Gas, and Modernizing the U.S. Generating Fleet," Great Lakes Symposium on Smart Grid and the New Energy Economy, Chicago, October 19, 2011.

"Pricing in a Western Energy Imbalance Market: Market Clearing Price versus Pay-As-Bid Pricing." Western Interstate Energy Board – Webinar on the Energy Imbalance Market," October 18, 2011.

"Federal and State Legislative and Regulatory Outlook: Connecting the Dots: Options for Upcoming Electric Resources," Emerging Issues Policy Forum, Amelia Island, October 9, 2011.

"Environmental Challenges Associated with Meeting Future Energy Needs: The role of shale gas?" National Association of Clean Air Agencies, Cleveland, October 4, 2011.

"Facing tough realities: Upcoming Energy and Environmental Issues – With a Focus on Electricity and Natural Gas," National Association of Clean Air Agencies, Cleveland, October 4, 2011.

"Assessing Natural Gas' New Promises and Controversies: Strategies to Improve the Safety & Environmental Performance of Shale Gas Extraction," Wisconsin Public Utilities Institute, University of Wisconsin at Madison, October 3, 2011.

"The Outlook for Natural Gas: Role of Shale Gas," EnergySMART Conference, Boston, September 27, 2011.

"The Outlook for Natural Gas: What does shale gas look like?" NECA Fuels Conference, Marlboro, MA, September 27, 2011.

"Facing tough realities: Upcoming Energy and Environmental Issues – With a Focus on Electricity and Natural Gas," Environmental Council of the States, Indianapolis, September 25, 2011.

"Electric Reliability Under EPA's New Air Regulations: What We Know, and What We Can Do About What We Don't Yet Know," National Association of State Energy Offices, September 12, 2011.

"The Future of Electricity Generation in the U.S. – A Modest Set of Observations," 19th Annual MIT- NESCAUM Endicott House Symposium, August 18, 2011.

"Unconventional Approaches: Part of the Electric Industry's Response to Upcoming EPA Regulations," panel on Infrastructure Reliability and Adequacy at the Aspen Energy Policy Forum, Aspen, July 5, 2011.

"What we know, what we might know, and what we know we don't know yet," joint meeting of the NARUC, NASEO, and NACAA states, Baltimore, June 23, 2011.

"Facing tough realities: Energy and environmental issues in 2011 and beyond," joint meeting of the NARUC, NASEO, and NACAA states, Baltimore, June 23, 2011.

"China's Energy Challenges and Policy Responses: Observations from a U.S. Vantage Point," Connecticut College Vietnam Program, June 16, 2011.

"Strategies for Addressing Change at FERC and the RTOs: A new lens on responding to near-term changes," FERC/RTO Training Session, Institute Policy Integrity, New York, NY, July 15, 2011.

"'May you live in interesting times…': The Regulators' Tool-Kit in an Era of Uncertainty," Western Conference of Public Service Commissioner, Denver, June 14, 2011.

"Dirty to Clean? The Future of Electric Power in America," CERES Conference 2011, Oakland, CA, May 12, 2011.

"EPA Regulations, Power Generation Capacity & Reliability," MIT Center for Energy & Environmental Policy Research Workshop, Cambridge, MA, May 5, 2011.

"The Electric Industry's Response to EPA's Upcoming Regulations: Options for Owners and Others," Energy Bar Association, Panel on Environmental Regulations, Washington, D.C., May 4, 2011.

"Framing the Issues: Energy & the Environment," keynote address, Health Effects Institute, Boston, May 2, 2011.

"Federal Air Pollution Regulations Affecting Fossil Power Plants: Current issues, implications, strategies," Annual Conference on Tribal Energy in the Southwest, Law Seminars International, Phoenix, April 29, 2011.

"China and U.S. Energy and Environmental Policy Challenges: Learning from Each Other, In It Together," presentation to China Energy & Environment Conference, Harvard University, April 9, 2011.

"EPA's MACT, Water Cooling Intake and Transport Rules: What now for power generation?" presentation to SNL Energy Webinar, April 12, 2011.

"Policies for a Secure Energy Future: Issues in Supply and Demand," Aspen Institute Congressional Program (meeting on Energy Security: Policy Considerations in the New Congress), Puerto Rico, February 22–27, 2011.

"EPA's Regulations Affecting Coal Plants: Using a 21st Century Toolkit (or, upgrading to the "Champ" from the "Classic")," DOE/NARUC National Electricity Forum, Washington, D.C., February 16, 2011.

"Responding to EPA's Regulations Affecting Coal Plants: Using a 21st Century Toolkit (or, upgrading to the "Champ" from the "Classic")," NARUC Winter Meeting, Washington, D.C., February 14, 2011.

"Local, State and Regional Coordination and Solutions: Non-conventional capacity and energy resources," Bipartisan Policy Center's Workshop on Power Sector Environmental Regulations, Washington, D.C., January 19, 2011.

"Renewable Energy in New England," New Hampshire Business and Industry Conference, Concord, New Hampshire, December 7, 2010.

"Framing the Issues: Energy and the Environment," National Academy of Public Administration, Washington, D.C., November 18, 2010.

"Toolkit for Ensuring Reliable, Economic Responses to EPA's Proposed Air Regulations," NARUC Meeting, Atlanta, Georgia, November 17, 2010.

"Challenges for Recovering Costs During a Push for Cleaner Generation and More Efficient Energy Use," Law Seminars International conference (Utility Rate Cases), Boston, November 9, 2010.

"Public Policy for Advanced Energy Technology," New York Advanced Energy Technology Conference, New York, NY, November 8, 2010.

"Energy Future: Bridging the Gap," Wharton Energy meeting, Philadelphia, October 28, 2010.

"Upcoming Power Sector Environmental Regulations: Framing the issues about potential reliability/ cost impacts," National Commission on Energy Policy Workshop on Power Sector Environmental Regulations, Washington, D.C., October 22, 2010.

"Vulnerability of the Gulf Coast Energy Infrastructure," America's Energy Coast Policy Forum on The Future of the U.S. Gulf Coast Energy Infrastructure in the Face of Changing Climate, New Orleans, October 20, 2010.

"Today's Energy Landscape: Scanning the terrain – with tips for a safe journey," presentation to the annual meeting of the National Association of State Energy Officials, September 30, 2010.

"2020: What can we expect? Where we are now, and how it influences where we'll be a decade from now," Law Seminars International conference, "Energy in the Northeast," September 29, 2010.

"Today's Energy Landscape: Exploring economic, environmental and technological trends," annual meeting of the Independent Power Producers of New York, September 22, 2010.

"Transforming America's Energy Systems: Challenges and opportunities along the nation's coastal and marine environments," Annual Lecture at the Metcalf Institute, University of Rhode Island, June 8, 2010.

"New England at the Crossroads: The Intersection between Regulatory Policy and Future Energy Supply," presentation to the Northeast Energy and Commerce Association, 17th New England Energy Conference, Green Thumb on the Scale: Impact on Future Energy Choices, June 8, 2010.

"Is Competition Dead?" Annual Meeting of the New England Conference of Public Utility Commissioners, May 17, 2010.

"Why it is so Darn Hard to Adopt Advanced Energy Technologies, But So Worth the Effort," presentation to the Tufts University Energy Conference, "The Evolution of Energy," April 17, 2010.

"The Prospects for Natural Gas, Coal, and Nuclear Power in America's Energy Future," discussions with members of Congress at the Aspen Institute's Congressional Program on Energy Security and Climate Change: Policy Challenges for the Congress, April 6–10, 2010.

"Why is Modernizing Our Energy Technologies So Darn Hard, But Worth the Effort?" presentation to the MIT Energy Initiative Lecture Series, February 2, 2010.

SERVICE ON BOARDS OF DIRECTORS (PUBLIC COMPANIES, PRIVATE COMPANIES, NON-GOVERNMENTAL ORGANIZATIONS)

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Member, Renegy Holdings Board of Directors, 2007–2009)

Member, Clean Air Task Force Board of Directors, 2008–2013)
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Member, Climate Policy Center Board of Directors (2001–2007)

Member, NorthEast States Center for a Clean Air Future, Board of Directors (1998–2010)

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Member, Electric Power Research Institute (EPRI) Board of Directors (1998–2003, 2005–2006)

Chair, Electricity Innovations Institute, Board of Directors, (2002–2004); Director (2001–2002)

Director, The Randers Group (subsidiary of Thermo TERRATEK) Board of Directors (1997–2000)

Director, Thermo ECOTEK Corporation Board of Directors (1996–1999)

OTHER PROFESSIONAL ACTIVITIES

Member, Committee on Accelerating Decarbonization in the United States: Technology, Policy and Social Dimensions, National Academies of Sciences, Engineering & Medicine (2020-present)

Member, Climate Crossroads Planning Committee, National Academies of Sciences, Engineering & Medicine (2022-present)

Member, Committee on Net Metering, National Academies of Sciences, Engineering & Medicine (2021-present)

Member, Committee on the Modernization of the Electric Grid, National Academies of Sciences, Engineering & Medicine, Climate Communications Initiative (2019-2021)

Member, Advisory Committee of the National Academy of Sciences, Engineering & Medicine, Climate Communications Initiative (2018-present)

Chair, External Advisory Council, National Renewables Energy Laboratory (2009–present)

Member, Columbia University, Center for Global Energy Policy (2014–2018, 2020-Present)

Member, Institute for Policy Integrity, New York University School of Law (2017-Present)

Member, New York Independent System Operator, Environmental/Advisory Council (2004–Present)

Member, Technical Review Panels at National Renewable Energy Laboratory: Member, Energy Systems Integration TRP (2021-present); Chair, Computational Sciences and Energy Analysis TRP (2018-2021); Chair, Energy Analysis TRP (2009-2018).

Visiting Fellow in Policy Practice at the Energy Policy Institute at the University of Chicago (2017–2018)

Chair and Member, Electricity Advisory Committee (Department of Energy) (2015–2017)

Member, National Academy of Sciences Committee on Enhancing the Resiliency of the Nation's Electric Power Transmission and Distribution System (2015–2017)

Chair, Aspen Institute Energy Policy Forum (2015)

Member, Innovation Review Panel, "51st State" Initiative of the Solar Electric Power Association (2015)

Chair, External Review Panel for the Clean Energy Ministerial (2015)

Chair, Aspen Institute Energy Policy Forum (2014)

Participant in studies of the Colorado State University's Center for Clean Energy Economy ("*Powering*

Forward: Presidential and Executive Agency Actions to Drive Clean Energy in America") (January 2014)

Co-Lead Convening Author, Energy Supply and Use Chapter, National Climate Assessment (2012–2014)

Member, Committee on Risk Management and Government Issues in Shale Gas Development, of the National Academy of Sciences, Board on Environmental Change and Society (of the Division of Behavioral and Social Sciences and Education) (2013–2014)

Co-chair, Bipartisan Policy Center's Cyber-security and the Electric Grid project (2013–2014)

Co-chair, National American Energy Standards Board (NAESB) Gas-Electric Harmonization Committee

(2012, 2014)

Alliance Commission on National Energy Efficiency Policy (2012–2013): Report "Energy 2030: Doubling

Energy Productivity by 2030" (February 2013)

Bipartisan Policy Center – Energy Project (2011–Present): Report ("America's Energy Resurgence: Sustaining Success, Confronting Challenges" (February 2013)

U.S. Secretary of Energy Advisory Board (July 2010–May 2013). Member of the Natural Gas Subcommittee examining shale gas development. (2011–2013)

Chair, Policy Subgroup of the National Petroleum Council's study on North American Gas and Oil

Resource Development (2010–2011)

Visiting Professor, Department of Urban Studies & Planning, Massachusetts Institute of Technology

(Spring 2010)

Massachusetts Clean Energy Grand Prize Judge (2010)

World Resources Institute: Chair of Presidential Search Committee (2011)

Co-Lead, Department of Energy Agency Review Team, Obama/Biden Presidential Transition Team, Washington D.C., while on full-time leave for four months from Analysis Group (2008–2009)

Chair, Massachusetts Ocean Advisory Commission (2008–2010)

Member, Blue Ribbon Commission on Cost-Allocation Issues for Transmission Investment, WIRES (2007) Member, National Academy of Sciences Committee on Enhancing the Robustness and Resilience of

Electrical Transmission and Distribution in the United States to Terrorist Attack (2005–2008)

Member, National Commission on Energy Policy, Member (2002–2011); Co-chair (2009–2011) Member, Advisory Committee, Carnegie Mellon Electricity Industry Center (2001–2009)

Member, Policy Advisory Committee, China Sustainable Energy Project–A Joint Project of The Packard

Foundation and The Energy Foundation (1999–2014)

Co-Chair, Energy/Environment Working Group, Governor Deval Patrick Transition Team (2006–2007) Presenter, Economic Issues, National LNG Forums, U.S. Department of Energy, Boston Massachusetts

Astoria, Oregon (2006)

Chair of the Technical Review Panel, Critical Infrastructure Protection Decision Support Systems (CIP- DSS), Argonne, Los Alamos and Sandia National Laboratories (2006)

Advisory Council member, New England Energy Alliance (2005–2006)

Chair of the Laboratory Direction's Division Review Panel for the Environmental Energy Technologies

Division, Lawrence Berkeley National Laboratory (2005)

Chair, Ocean Management Task Force, Commonwealth of Massachusetts (2003–2004) Co-Chair, RTO Futures: Regional Power Working Group (2001–2002)

Member, Florida Energy 2020 Study Commission, Environmental Technical Advisory Committee (2001) Technical Advisor, Mid-Atlantic Area Council/PJM, Dispute Resolution Procedure (1998–2008)

Member, "ISO-New England" (Independent System Operator) Advisory Committee (1998–2003)

Member, United States Department of Energy, Electricity Reliability Task Force (1996–1998) Member, Harvard Electricity Policy Group (1993–2005)

HONORS AND AWARDS

Lifetime National Associate of the National Research Council of the National Academies of Sciences, Engineering and Medicine (January 2020)

Mary Kilmarx Award for lifetime work on good government, clean energy and the environment, presented by NARUC's Committee on Energy Resources and the Environment (November 2015)

Lifetime Achievement Award, U.S. Department of Energy/MIT/Clean Energy Ministerial C3E (CleanEnergy Education & Empowerment) Initiative (2014)

Champions Award, Charles River Watershed Association (2013)

Leadership Award, New England Women in Energy and the Environment (2013) Clean Energy Hall of Fame, New England Clean Energy Council (2012)

DOE Women in Clean Energy Initiative, C3 Ambassador (2012)

Climate Champion Award, Clean Air – Cool Planet (2009)

Distinguished Alumna Award, Scripps College, Claremont, CA (1998)

Award for Individual Leadership in Public Service, *The Energy Daily* (1995)

Special Recognition Award, Outstanding Contribution to the Industry, Assn of Energy Engineers (1994)

Leadership Award, National Association of State Energy Officials (1994)

Commencement Speaker and Honorary Doctorate of Laws, Regis College, Weston, MA (1992)

APPENDIX B
Materials Considered

Legal Documents

Disclosure Statement for Modified Second Amended Title III Plan of Adjustment of the Puerto Rico Electric Power Authority, *In re: The Financial Oversight and Management Board for Puerto Rico, as a representative of the Commonwealth of Puerto Rico, et al., Debtors*, PROMESA Title III No. 17-BK-3283-LTS, and *In re: The Financial Oversight and Management Board for Puerto Rico, as a representative of Puerto Rico Electric Power Authority, Debtor*, PROMESA Title III No. 17-BK-4780-LTS (Jointly Administered), United States District Court for the District of Puerto Rico, San Juan, Puerto Rico, March 1, 2023.

Responses And Objections Of LUMA Energy, LLC And LUMA Servco, LLC To The Bondholders' Document Requests, *In re: The Financial Oversight and Management Board for Puerto Rico, as a representative of the Commonwealth of Puerto Rico, et al., Debtors*, PROMESA Title III No. 17-BK-3283-LTS, and *In re: The Financial Oversight and Management Board for Puerto Rico, as a representative of Puerto Rico Electric Power Authority, Debtor*, PROMESA Title III No. 17-BK-4780-LTS (Jointly Administered), United States District Court for the District of Puerto Rico, San Juan, Puerto Rico, April 12, 2023.

Expert Reports

Expert Report of Maureen M. Chakraborty, PhD, April 28, 2023, and associated Exhibits.

Expert Report of Sebastian Edwards, April 28, 2023, and associated Exhibits.

Bates Stamped Documents

Buchsbaum, Jesse, "Long-Run Price Elasticities and Mechanisms: Empirical Evidence from Residential Electricity Consumers," *Energy Institute Working Paper 331,* 2022, FOMB_PREPA 00022518 - FOMB_PREPA 00022589, available at https://haas.berkeley.edu/wp-content/uploads/WP331.pdf.

Burke, Paul J. and Ashani Abayasekara, "The Price Elasticity of Electricity Demand in the United States: A Three-Dimensional Analysis," *The Energy Journal*, Vol. 39, 2018, available at https://doi.org/10.5547/01956574.39.2.pbur. FOMB_PREPA 00020208 - FOMB_PREPA 00020243.

"Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx," FOMB_PREPA 00020150.

"FOMB - June 2020 PREPA CFP Model_vS.03.xlsx," FOMB_PREPA 00024556.

"FOMB - May 2021 FP Model_Data_Room_vF2.xlsx," FOMB_PREPA 00020362.

"Government Accounts Receivable March 2022.xlsx," FOMB_PREPA 00001467.

"January 2022 Fiscal Plan Model Certified (Dataroom).xlsx," FOMB_PREPA 00020359.

Letter from Covington and DLA Piper to Proskauer, FOMB_PREPA 00023701.

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PREPA, "2022 Certified Fiscal Plan for the Puerto Rico Electric Power Authority," FOMB_PREPA 00000699 - FOMB_PREPA 00000882.

"PREPA 2022 Fiscal Plan Model.xlsx," FOMB_PREPA 00003018.

"PREPA 2022 FP Alternative Forecast.xlsx," FOMB_PREPA 00003022.

"20221115 Risk model.xlsx", FOMB_PREPA 00022385.

Siemens, "Puerto Rico Integrated Resource Plan 2018-2019," FOMB_PREPA 00024202 - FOMB_PREPA 00024531

Data

LUMA Energy, "Load Forecast FY 2023," June 21, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/06/Load-Forecast-FY-2023_Values-3.xlsx.

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California Public Utilities Commission, Decision Revising Net Energy Metering Tariff and Subtariffs, Docket No. 20-08-020, Order Instituting Rulemaking to Revisit Net Energy Metering Tariffs Pursuant to Decision 16-01-044, and to Address Other Issues Related to Net Energy Metering, December 15, 2022, p. 209, available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043682.PDF.

DSIRE, "Distributed Generation Tariffs," March 3, 2023, available at https://programs.dsireusa.org/system/program/detail/596.

DSIRE, "Puerto Rico – Net Metering," October 12, 2021, available at https://programs.dsireusa.org/system/program/detail/2846/puerto-rico-net-metering.

Financial Oversight & Management Board of Puerto Rico, "Puerto Rico's Debt Restructuring Process," available at https://oversightboard.pr.gov/debt/.

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National Academies of Sciences, Engineering and Medicine, *The Future of Electric Power in the U.S.*, The National Academies Press, 2021, available at https://doi.org/10.17226/25968.

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Office of Management and Budget, Puerto Rico Energy Public Policy Act, Act. No. 17 of April 11, 2019, available at https://bvirtualogp.pr.gov/ogp/Bvirtual/leyesreferencia/PDF/2-ingles/17-2019.pdf.

Office of Management and Budget, Puerto Rico Energy Transformation and RELIEF Act, Act No. 57 of May 27, 2014, as amended, Section 6.29B — Energy Efficiency (codified as 22 L.P.R.A. § 1054bb-2), available at https://bvirtualogp.pr.gov/ogp/Bvirtual/leyesreferencia/PDF/2-ingles/57-2014.pdf.

Office of Management and Budget, Puerto Rico Net Metering Act, Act. No. 114 of August 16, 2007, as amended, available at https://bvirtualogp.pr.gov/ogp/Bvirtual/leyesreferencia/PDF/2-ingles/114-2007.pdf.

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PREB, "Request for Proposals: Energy Efficiency Baseline and Potential Studies," April 27, 2022, available at https://static1.squarespace.com/static/61ea784947109b1572ec37ec/t/627cca4e2ddcae3086a1faf5/1652345423614/NEPR+EE+Study+RFP+revised.pdf.

PREB, Regulation for Energy Efficiency, Article 3, Energy Efficiency Savings Targets, March 25, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/04/Reglamento-9367-Regulation-for-Energy-Efficiency.pdf.

PREPA Governing Board, Resolution 5027, "Approval of a Memorandum of Understanding Between the Puerto Rico Electric Power Authority and Puerto Rico Aqueduct and Sewer Authority," February 24, 2023, available at https://aeepr.com/es-pr/jpportal/Resoluciones/Resolution%205027%20-%20Approval%20of%20a%20Memorandum%20of%20Understanding%20between%20PREPA%20and%20PRASA.pdf.

PREPA, "Tariff Book - Electric Service Rates and Riders," May 28, 2019, available at https://aeepr.com/es-pr/QuienesSomos/Ley57/Facturaci%C3%B3n/Tariff%20Book%20-%20Electric%20Service%20Rates%20and%20Riders%20Revised%20by%20Order%2005172019%20Approved%20by%20Order%2005282019.pdf.

PREPA, "2019 FOMB - Fiscal Plan for PREPA, as Certified by FOMB on June 27 2019," June 27, 2019, available at https://aeepr.com/es-pr/Documents/Exhibit%201%20-%202019%20Fiscal_Plan_for_PREPA_Certified_FOMB%20on_June_27_2019.pdf.

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Tierney, Susan, "The Value of 'DER' to 'D': The Role of Distributed Energy Resources in Supporting Local Electric Distribution System Reliability," *Analysis Group*, March 31, 2016, available at https://www.analysisgroup.com/globalassets/content/news_and_events/news/value_of_der_to-_d.pdf.

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Zhu, Xing, Lanlan Li, Kaile Zhou, Xiaoling Zhang, and Shanlin Yang, "A Meta-Analysis on the Price Elasticity and Income Elasticity of Residential Electricity Demand," *Journal of Cleaner Production,* Vol. 201, November 10, 2018, available at https://www.sciencedirect.com/science/article/abs/pii/S0959652618323588.

Appendix C: Macroeconomic Forecasts Underlying 2022 PREPA Fiscal Plan

Table C-1: GNP and Population Forecasts Underlying 2022 PREPA Fiscal Plan

Fiscal Year	Real GNP (Millions $)	Population (Millions)
2021	5,761	3.323
2022	5,913	3.279
2023	5,968	3.241
2024	5,927	3.208
2025	5,928	3.177
2026	5,947	3.152
2027	6,005	3.137
2028	6,033	3.122
2029	6,028	3.104
2030	6,008	3.081
2031	5,998	3.055
2032	5,954	3.027
2033	5,912	3.000
2034	5,864	2.973
2035	5,815	2.946
2036	5,731	2.916
2037	5,672	2.884
2038	5,625	2.851
2039	5,587	2.818
2040	5,557	2.786
2041	5,558	2.755
2042	5,501	2.724
2043	5,477	2.694
2044	5,455	2.665
2045	5,434	2.637
2046	5,415	2.612
2047	5,402	2.587
2048	5,387	2.564
2049	5,372	2.542
2050	5,361	2.520
2051	5,351	2.520

Notes:
[1] The PREPA Gross Load Forecast uses the population series from the Commonwealth 2022 Certified Fiscal Plan on a one year lag.
[2] The PREPA Gross Load Forecast uses the Real GNP projection without Income Adjustments from the Commonwealth 2022 Certified Fiscal Plan.

Sources:
[1] "January 2022 Fiscal Plan Model Certified (Dataroom).xlsx," FOMB_PREPA 00020359.
[2] LUMA Energy, “Load Forecast FY 2023,” June 21, 2022, available at https://energia.pr.gov/wp-content/uploads/sites/7/2022/06/Load-Forecast-FY-2023_Values-3.xlsx

Appendix D: Modified Net Load Forecasts

Table D-1: Annual Net Load Under PREPA Alternative Forecast

Fiscal Year	Residential (GWh)	Commercial (GWh)	Industrial (GWh)	Public Lighting (GWh)	Agricultural (GWh)	Others (GWh)	Total (GWh)
2023	6,977	7,347	1,884	275	27	38	**16,547**
2024	6,793	7,151	1,825	276	27	38	**16,109**
2025	6,694	7,025	1,799	240	27	38	**15,823**
2026	6,614	6,899	1,838	206	27	38	**15,621**
2027	6,560	6,756	1,828	172	27	38	**15,380**
2028	6,506	6,616	1,790	138	27	38	**15,114**
2029	6,432	6,470	1,688	137	27	38	**14,792**
2030	6,335	6,317	1,591	137	27	38	**14,445**
2031	6,220	6,150	1,589	137	27	38	**14,160**
2032	6,093	5,980	1,576	138	27	38	**13,852**
2033	5,960	5,885	1,548	137	27	38	**13,595**
2034	5,848	5,809	1,397	137	27	38	**13,257**
2035	5,764	5,735	1,338	137	27	38	**13,039**
2036	5,671	5,660	1,273	138	27	38	**12,807**
2037	5,571	5,581	1,211	137	27	38	**12,565**
2038	5,484	5,521	1,172	138	27	38	**12,379**
2039	5,395	5,451	1,145	137	27	38	**12,193**
2040	5,303	5,377	1,117	137	27	38	**11,999**
2041	5,218	5,295	1,119	137	27	38	**11,834**
2042	5,131	5,216	1,077	138	27	38	**11,627**
2043	5,036	5,131	1,033	137	27	38	**11,402**
2044	4,948	5,044	1,007	137	27	38	**11,201**
2045	4,855	4,951	983	137	27	38	**10,990**
2046	4,772	4,865	961	138	27	38	**10,800**
2047	4,687	4,774	945	137	27	38	**10,609**
2048	4,604	4,684	930	137	27	38	**10,420**
2049	4,514	4,586	915	137	27	38	**10,217**
2050	4,431	4,492	903	138	27	38	**10,029**
2051	4,432	4,264	941	138	27	38	**9,840**

Sources:

[1] 2022 PREPA Fiscal Plan Model.

[2] 2022 PREPA Fiscal Plan Alternative Forecast Model.

Table D-2: Annual Net Load Under PREPA Alternative Forecast and Macro Scenario 1: World Bank Population and Edwards GNP

Fiscal Year	Residential (GWh)	Commercial (GWh)	Industrial (GWh)	Public Lighting (GWh)	Agricultural (GWh)	Others (GWh)	Total (GWh)
2023	6,940	7,324	1,883	275	27	38	**16,487**
2024	6,822	7,161	1,850	276	27	38	**16,173**
2025	6,796	7,064	1,874	240	27	38	**16,039**
2026	6,776	6,964	1,948	206	27	38	**15,958**
2027	6,774	6,842	1,978	172	27	38	**15,830**
2028	6,770	6,714	1,993	138	27	38	**15,680**
2029	6,741	6,577	1,954	137	27	38	**15,474**
2030	6,686	6,430	1,915	137	27	38	**15,233**
2031	6,601	6,268	1,956	137	27	38	**15,026**
2032	6,499	6,102	1,979	138	27	38	**14,782**
2033	6,388	6,009	1,984	137	27	38	**14,582**
2034	6,293	5,935	1,863	137	27	38	**14,293**
2035	6,228	5,861	1,839	137	27	38	**14,130**
2036	6,158	5,786	1,818	138	27	38	**13,965**
2037	6,085	5,709	1,800	137	27	38	**13,795**
2038	6,024	5,651	1,801	138	27	38	**13,679**
2039	5,963	5,586	1,816	137	27	38	**13,566**
2040	5,900	5,516	1,828	137	27	38	**13,446**
2041	5,844	5,438	1,875	137	27	38	**13,359**
2042	5,782	5,363	1,870	138	27	38	**13,217**
2043	5,709	5,280	1,859	137	27	38	**13,050**
2044	5,644	5,196	1,868	137	27	38	**12,910**
2045	5,571	5,104	1,877	137	27	38	**12,753**
2046	5,505	5,018	1,886	138	27	38	**12,612**
2047	5,436	4,927	1,904	137	27	38	**12,469**
2048	5,369	4,834	1,926	137	27	38	**12,330**
2049	5,294	4,733	1,949	137	27	38	**12,177**
2050	5,226	4,635	1,976	138	27	38	**12,039**
2051	5,140	4,517	2,050	138	27	38	**11,910**

Sources:

[1] Expert Report of Dr. Sebastian Edwards, Appendix C.

[2] 2022 PREPA Fiscal Plan Model.

[3] 2022 PREPA Fiscal Plan Alternative Forecast Model.

[4] 2019 IRP.

Table D-3: Annual Net Load Under PREPA Alternative Forecast and Macro Scenario 2: 2022 Commonwealth Fiscal Plan Population and GNP Including COVID-19 Income Adjustment

Fiscal Year	Residential (GWh)	Commercial (GWh)	Industrial (GWh)	Public Lighting (GWh)	Agricultural (GWh)	Others (GWh)	Total (GWh)
2023	7,216	7,347	2,336	275	27	38	**17,237**
2024	7,007	7,151	2,230	276	27	38	**16,729**
2025	6,872	7,025	2,134	240	27	38	**16,336**
2026	6,760	6,899	2,113	206	27	38	**16,043**
2027	6,688	6,756	2,071	172	27	38	**15,751**
2028	6,630	6,616	2,024	138	27	38	**15,473**
2029	6,556	6,470	1,922	137	27	38	**15,149**
2030	6,458	6,317	1,824	137	27	38	**14,801**
2031	6,343	6,150	1,820	137	27	38	**14,515**
2032	6,215	5,980	1,807	138	27	38	**14,205**
2033	6,082	5,885	1,778	137	27	38	**13,947**
2034	5,969	5,809	1,626	137	27	38	**13,607**
2035	5,885	5,735	1,566	137	27	38	**13,388**
2036	5,791	5,660	1,500	138	27	38	**13,153**
2037	5,690	5,581	1,436	137	27	38	**12,909**
2038	5,603	5,521	1,396	138	27	38	**12,721**
2039	5,512	5,451	1,367	137	27	38	**12,533**
2040	5,420	5,377	1,337	137	27	38	**12,336**
2041	5,334	5,295	1,339	137	27	38	**12,170**
2042	5,246	5,216	1,294	138	27	38	**11,959**
2043	5,150	5,131	1,247	137	27	38	**11,730**
2044	5,061	5,044	1,219	137	27	38	**11,526**
2045	4,966	4,951	1,193	137	27	38	**11,312**
2046	4,882	4,865	1,169	138	27	38	**11,119**
2047	4,797	4,774	1,152	137	27	38	**10,925**
2048	4,713	4,684	1,136	137	27	38	**10,734**
2049	4,622	4,586	1,119	137	27	38	**10,528**
2050	4,538	4,492	1,105	138	27	38	**10,338**
2051	4,440	4,379	1,142	138	27	38	**10,163**

Sources:

[1] Expert Report of Dr. Sebastian Edwards, Appendix C.
[2] 2022 PREPA Fiscal Plan Model.
[3] 2022 PREPA Fiscal Plan Alternative Forecast Model.
[4] 2019 IRP.

Appendix E: Adjustments to PREPA Base Rates Under Revised Net Load Forecasts

PREPA's non-Legacy-Charge revenue requirement comprises both fixed and variable costs, and is collected through "base rates" charged to its customers. If PREPA's load forecasts are revised, then its fixed costs must be spread over a different set of loads, and its base rates must also change. This Appendix describes my methodology for adjusting PREPA's base rates under revised net load forecasts.

In the 2022 PREPA Fiscal Plan and the FOMB's Revenue Envelope and Legacy Charge Model, PREPA's non-Legacy Charge revenue requirement is assumed to be collected through base rates in the categories of "Basic Revenue," "Fuel & Purchased Power," "CILT," Subsidies", and "ERS Pension."[1] FOMB assumes that the costs collected through the "Basic Revenues" and "ERS Pension" rates are 100% fixed, the costs collected through the "Fuel & Purchased Power" rate are 10% fixed and 90% variable, and the costs collected through the "CILT" and "Subsidies" rates are 97.5% fixed and 2.5% variable.[2]

With revised net load forecasts, the base rates for the residential, commercial, and industrial classes used in calculating the Revenue Envelope must be adjusted to account for the revised net loads of each customer class, so that revenues collected from the base rates cover both the fixed costs (unchanged under a revised load forecast) and revised variable costs (which change proportionally with the revised load forecast).[3] The adjustment calculation proceeds in the following steps in each fiscal year:

1. The ratios of the revised net load forecasts to the original 2022 PREPA Fiscal Plan net load forecasts are calculated for each customer class (see rows 29-31).[4]
2. The revenue generated from each customer class's "Basic Revenue" rates is assumed to cover 100% fixed costs which stay constant even as the net load forecast changes. Therefore, the adjusted "Basic Revenue" rates are calculated by dividing by these ratios for each customer class

[1] Revenue Envelope and Legacy Charge Model, tab "Revenue Recovery Rates."
[2] Revenue Envelope and Legacy Charge Model, tab "Revenues Available."
[3] See rows 10-12 of "Base Rate Adjustment.xlsx," tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP".
[4] See tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP" of "Base Rate Adjustment.xlsx".

(see rows 34-36).[5] For example, if the new residential net load is 1% higher than the residential net load in the Fiscal Plan net load forecast, then the "Basic Revenue" rate for the residential class is adjusted by dividing by 1.01. This adjustment ensures that "Basic Revenue" rates for each customer class continues to cover the same level of fixed costs even under the revised load forecasts.

3. For other volumetric rates used in calculating the revenue envelope (Fuel & Purchased Power, CILT, Subsidies, and ERS Pension Charge, rows 5-8), the board assumes a percentage of the revenues generated by each are fixed (the percentages assumed fixed are listed in column D).[6] For these categories, the rate is adjusted by splitting it into a fixed component and a variable component.
    a. The fixed components are adjusted in exactly the same way as the "Basic Revenue" rates for customer classes described in Step 2, but using the ratio of the revised total net load forecasts to the original 2022 PREPA Fiscal Plan total net load forecasts (see row 32).[7]
    b. The variable component of each rate, on the other hand, is first assumed to increase proportionally to the ratio of modified total net load to the Fiscal Plan total net load, but is also assumed to be spread out over more units of consumption, and therefore multiplied by the ratio of the Fiscal Plan net load to the modified net load. These two effects cancel each other out, and there is no net adjustment to the variable component of each rate.
    c. The adjusted rates are then calculated by recombining the fixed and variable components (see rows 38-41).[8]

[5] See tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP" of "Base Rate Adjustment.xlsx".
[6] See tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP" of "Base Rate Adjustment.xlsx".
[7] See tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP" of "Base Rate Adjustment.xlsx".
[8] See tabs "Alternative Model," "+Macro 1 WB Pop Edwards GNP," and "+Macro 2 CW FP Pop and GNP" of "Base Rate Adjustment.xlsx".

Table E-1: PREPA Base Rates under PREPA Alternative Forecast

Fiscal Year	Residential Base Rate ($/kWh)	Commercial Base Rate ($/kWh)	Industrial Base Rate ($/kWh)	ERS Pension Charge ($/kWh)	Fuel & Purchased Power ($/kWh)	CILT ($/kWh)	Subsidies ($/kWh)
2024	$0.0602	$0.0813	$0.0472	$0.0241	$0.1225	$0.0071	$0.0156
2025	$0.0585	$0.0784	$0.0467	$0.0211	$0.1253	$0.0054	$0.0120
2026	$0.0580	$0.0782	$0.0446	$0.0212	$0.1333	$0.0056	$0.0115
2027	$0.0574	$0.0782	$0.0441	$0.0213	$0.1453	$0.0059	$0.0111
2028	$0.0568	$0.0782	$0.0437	$0.0214	$0.1437	$0.0063	$0.0110
2029	$0.0564	$0.0784	$0.0449	$0.0215	$0.1454	$0.0065	$0.0112
2030	$0.0561	$0.0787	$0.0475	$0.0216	$0.1477	$0.0067	$0.0114
2031	$0.0560	$0.0793	$0.0477	$0.0163	$0.1506	$0.0070	$0.0116
2032	$0.0560	$0.0800	$0.0478	$0.0147	$0.1540	$0.0071	$0.0119
2033	$0.0560	$0.0796	$0.0455	$0.0144	$0.1589	$0.0074	$0.0120
2034	$0.0558	$0.0791	$0.0491	$0.0142	$0.1626	$0.0078	$0.0124
2035	$0.0553	$0.0786	$0.0504	$0.0139	$0.1666	$0.0081	$0.0126
2036	$0.0549	$0.0781	$0.0513	$0.0136	$0.1710	$0.0085	$0.0128
2037	$0.0545	$0.0778	$0.0522	$0.0133	$0.1759	$0.0086	$0.0130
2038	$0.0546	$0.0772	$0.0527	$0.0128	$0.1804	$0.0090	$0.0132
2039	$0.0542	$0.0760	$0.0527	$0.0124	$0.1877	$0.0093	$0.0134
2040	$0.0537	$0.0748	$0.0531	$0.0120	$0.1950	$0.0098	$0.0137
2041	$0.0537	$0.0757	$0.0526	$0.0115	$0.2077	$0.0103	$0.0139
2042	$0.0536	$0.0765	$0.0532	$0.0111	$0.2079	$0.0107	$0.0143
2043	$0.0535	$0.0775	$0.0539	$0.0107	$0.1860	$0.0110	$0.0145
2044	$0.0534	$0.0785	$0.0543	$0.0103	$0.2076	$0.0110	$0.0145
2045	$0.0534	$0.0797	$0.0547	$0.0099	$0.2177	$0.0111	$0.0146
2046	$0.0534	$0.0808	$0.0550	$0.0094	$0.2253	$0.0111	$0.0146
2047	$0.0534	$0.0821	$0.0553	$0.0089	$0.2349	$0.0111	$0.0146
2048	$0.0533	$0.0834	$0.0554	$0.0085	$0.2432	$0.0111	$0.0146
2049	$0.0535	$0.0849	$0.0557	$0.0080	$0.2502	$0.0112	$0.0147
2050	$0.0045	$0.0864	$0.0558	$0.0075	$0.2590	$0.0112	$0.0148
2051	$0.0045	$0.0891	$0.0548	$0.0070	$0.2679	$0.0113	$0.0148

Sources:

[1] Revenue Envelope and Legacy Charge Model.

[2] 2022 PREPA Fiscal Plan Model.

[3] 2022 PREPA Fiscal Plan Alternative Forecast Model.

Table E-2: PREPA Residential/Commercial/Industrial Base Rates under PREPA Alternative Forecast and Macro Scenario 1: World Bank Population and Edwards GNP

Fiscal Year	Residential Base Rate ($/kWh)	Commercial Base Rate ($/kWh)	Industrial Base Rate ($/kWh)	ERS Pension Charge ($/kWh)	Fuel & Purchased Power ($/kWh)	CILT ($/kWh)	Subsidies ($/kWh)
2024	$0.0599	$0.0812	$0.0465	$0.0240	$0.1224	$0.0071	$0.0156
2025	$0.0577	$0.0780	$0.0448	$0.0209	$0.1251	$0.0054	$0.0118
2026	$0.0566	$0.0775	$0.0421	$0.0208	$0.1330	$0.0054	$0.0113
2027	$0.0556	$0.0772	$0.0407	$0.0207	$0.1449	$0.0057	$0.0108
2028	$0.0546	$0.0771	$0.0393	$0.0206	$0.1433	$0.0061	$0.0106
2029	$0.0538	$0.0771	$0.0388	$0.0205	$0.1448	$0.0062	$0.0107
2030	$0.0532	$0.0774	$0.0395	$0.0205	$0.1470	$0.0064	$0.0109
2031	$0.0528	$0.0778	$0.0388	$0.0154	$0.1498	$0.0066	$0.0110
2032	$0.0525	$0.0784	$0.0381	$0.0138	$0.1532	$0.0067	$0.0111
2033	$0.0522	$0.0780	$0.0355	$0.0135	$0.1580	$0.0069	$0.0112
2034	$0.0518	$0.0774	$0.0368	$0.0132	$0.1616	$0.0072	$0.0115
2035	$0.0512	$0.0769	$0.0366	$0.0129	$0.1655	$0.0075	$0.0116
2036	$0.0505	$0.0764	$0.0359	$0.0125	$0.1697	$0.0078	$0.0117
2037	$0.0499	$0.0760	$0.0351	$0.0121	$0.1745	$0.0079	$0.0119
2038	$0.0497	$0.0754	$0.0343	$0.0116	$0.1789	$0.0081	$0.0120
2039	$0.0490	$0.0741	$0.0333	$0.0112	$0.1861	$0.0084	$0.0121
2040	$0.0483	$0.0729	$0.0325	$0.0107	$0.1933	$0.0088	$0.0122
2041	$0.0479	$0.0737	$0.0314	$0.0102	$0.2058	$0.0092	$0.0124
2042	$0.0475	$0.0744	$0.0306	$0.0098	$0.2059	$0.0095	$0.0127
2043	$0.0472	$0.0753	$0.0300	$0.0094	$0.1841	$0.0097	$0.0128
2044	$0.0468	$0.0762	$0.0293	$0.0089	$0.2054	$0.0096	$0.0127
2045	$0.0466	$0.0773	$0.0286	$0.0085	$0.2152	$0.0096	$0.0126
2046	$0.0463	$0.0783	$0.0280	$0.0081	$0.2227	$0.0095	$0.0125
2047	$0.0460	$0.0795	$0.0274	$0.0076	$0.2320	$0.0095	$0.0125
2048	$0.0457	$0.0808	$0.0268	$0.0071	$0.2401	$0.0094	$0.0124
2049	$0.0456	$0.0823	$0.0261	$0.0067	$0.2469	$0.0094	$0.0124
2050	$0.0038	$0.0838	$0.0255	$0.0062	$0.2555	$0.0094	$0.0124
2051	$0.0038	$0.0841	$0.0251	$0.0058	$0.2640	$0.0094	$0.0123

Sources:

[1] Revenue Envelope and Legacy Charge Model.

[2] 2022 PREPA Fiscal Plan Model.

[3] 2022 PREPA Fiscal Plan Alternative Forecast Model.

[4] Expert Report of Susan Tierney, PhD, April 28, 2023, Appendix D.

Table E-3: PREPA Residential/Commercial/Industrial Base Rates under PREPA Alternative Forecast and Macro Scenario 2: 2022 Commonwealth Fiscal Plan Population and GNP Including COVID-19 Income Adjustment

Fiscal Year	Residential Base Rate ($/kWh)	Commercial Base Rate ($/kWh)	Industrial Base Rate ($/kWh)	ERS Pension Charge ($/kWh)	Fuel & Purchased Power ($/kWh)	CILT ($/kWh)	Subsidies ($/kWh)
2024	$0.0583	$0.0813	$0.0386	$0.0232	$0.1220	$0.0068	$0.0151
2025	$0.0570	$0.0784	$0.0393	$0.0205	$0.1249	$0.0053	$0.0116
2026	$0.0567	$0.0782	$0.0388	$0.0207	$0.1330	$0.0054	$0.0112
2027	$0.0563	$0.0782	$0.0389	$0.0208	$0.1450	$0.0057	$0.0109
2028	$0.0558	$0.0782	$0.0387	$0.0209	$0.1434	$0.0061	$0.0107
2029	$0.0554	$0.0784	$0.0394	$0.0210	$0.1451	$0.0063	$0.0109
2030	$0.0550	$0.0787	$0.0414	$0.0211	$0.1473	$0.0066	$0.0112
2031	$0.0550	$0.0793	$0.0417	$0.0159	$0.1503	$0.0068	$0.0114
2032	$0.0549	$0.0800	$0.0417	$0.0143	$0.1537	$0.0069	$0.0116
2033	$0.0548	$0.0796	$0.0396	$0.0141	$0.1586	$0.0072	$0.0117
2034	$0.0546	$0.0791	$0.0422	$0.0139	$0.1623	$0.0076	$0.0121
2035	$0.0542	$0.0786	$0.0430	$0.0136	$0.1663	$0.0079	$0.0122
2036	$0.0537	$0.0781	$0.0435	$0.0133	$0.1706	$0.0083	$0.0124
2037	$0.0534	$0.0778	$0.0440	$0.0129	$0.1755	$0.0084	$0.0127
2038	$0.0535	$0.0772	$0.0443	$0.0125	$0.1800	$0.0087	$0.0128
2039	$0.0530	$0.0760	$0.0442	$0.0121	$0.1872	$0.0091	$0.0131
2040	$0.0526	$0.0748	$0.0444	$0.0117	$0.1946	$0.0096	$0.0133
2041	$0.0525	$0.0757	$0.0440	$0.0112	$0.2073	$0.0101	$0.0135
2042	$0.0524	$0.0765	$0.0443	$0.0108	$0.2074	$0.0105	$0.0139
2043	$0.0523	$0.0775	$0.0447	$0.0104	$0.1856	$0.0107	$0.0141
2044	$0.0522	$0.0785	$0.0449	$0.0100	$0.2072	$0.0107	$0.0141
2045	$0.0523	$0.0797	$0.0451	$0.0096	$0.2172	$0.0108	$0.0142
2046	$0.0522	$0.0808	$0.0452	$0.0091	$0.2248	$0.0108	$0.0142
2047	$0.0522	$0.0821	$0.0453	$0.0087	$0.2343	$0.0108	$0.0142
2048	$0.0521	$0.0834	$0.0454	$0.0082	$0.2426	$0.0108	$0.0142
2049	$0.0523	$0.0849	$0.0455	$0.0077	$0.2496	$0.0108	$0.0143
2050	$0.0044	$0.0864	$0.0456	$0.0073	$0.2584	$0.0109	$0.0143
2051	$0.0045	$0.0868	$0.0451	$0.0068	$0.2672	$0.0109	$0.0144

Sources:

[1] Revenue Envelope and Legacy Charge Model.

[2] 2022 PREPA Fiscal Plan Model.

[3] 2022 PREPA Fiscal Plan Alternative Forecast Model.

[4] Expert Report of Susan Tierney, PhD, April 28, 2023, Appendix D.

Appendix F: Elasticity Estimates Used by the FOMB and in Academic Literature

Short-Run Elasticities

Source	FOMB Legacy Charge Derivation	Burke Abayasekara (2018)	Buchsbaum (2022)	Zhu et al. (2018)	Labandeira et al. (2017)
Geography	Puerto Rico	Lower 48	California	Global	Global
Residential	-0.2	-0.1	-0.36	-0.228	-0.191
Commercial			–	–	-0.212
Industrial			–	–	-0.149
# Elasticity Estimates (If Applicable)				175	306

Long-Run Elasticities

Source	FOMB Legacy Charge Derivation	Burke Abayasekara (2018)	Buchsbaum (2022)	Zhu et al. (2018)	Labandeira et al. (2017)
Geography	Puerto Rico	Lower 48	California	Global	Global
Residential	-1.7	-1.0	-2.4	-0.577	-0.481
Commercial	-0.68 to -1.7	-0.3 to -0.6	–	–	-0.664
Industrial	-0.85 to -1.275	-1.2	–	–	-0.510
# Elasticity Estimates (If Applicable)				196	232

Notes:
[1] "Lower 48" indicates all U.S. states excluding Alaska and Hawaii.
[2] Burke and Abayasekara (2018) long-term estimates are rounded from non-IV cross-state estimates, and are used in FOMB's long-term elasticity estimates.
[3] Labandeira et al (2017) estimates are calculated as the sum of the intercept and the coefficient on each sector in tables A3 and A4 of their paper.
[4] Zhu et al (2018) estimates report the mean for short-term and long-term elasticities.
Sources:
[1] "Revenue Envelope and Legacy Charge_protected.xlsx"
[2] Burke, Paul J. and Ashani Abayasekara, "The Price Elasticity of Electricity Demand in the United States: A Three-Dimensional Analysis," The Energy Journal, Vol. 39, 2018, available at https://doi.org/10.5547/01956574.39.2.pbur. FOMB_PREPA 00020208 - FOMB_PREPA 00020243.
[3] Buchsbaum, Jesse, "Long-Run Price Elasticities and Mechanisms: Empirical Evidence from Residential Electricity Consumers," Energy Institute Working Paper 331, 2022, FOMB_PREPA 00022518 - FOMB_PREPA 00022589, available at https://haas.berkeley.edu/wp-content/uploads/WP331.pdf.
[4] Labandeira, Xavier, José M. Labeaga, and Xiral López-Otero, "A Meta-Analysis on the Price Elasticity of Energy Demand," Energy Policy, Vol. 102, March 2017, available at https://www.sciencedirect.com/science/article/abs/pii/S0301421517300022.
[5] Zhu, Xing, Lanlan Li, Kaile Zhou, Xiaoling Zhang, and Shanlin Yang, "A Meta-Analysis on the Price Elasticity and Income Elasticity of Residential Electricity Demand," Journal of Cleaner Production, Vol. 201, November 10, 2018, available at https://www.sciencedirect.com/science/article/abs/pii/S0959652618323588.